

# Graduate Catalog 2001-2003



**North Carolina  
Agricultural and Technical State University  
Greensboro, North Carolina**

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# **GRADUATE CATALOG OF NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY**

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STATE UNIVERSITY  
1601 East Market Street  
Greensboro, NC 27411



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GRADUATE PROGRAMS  
2001 – 2003  
GRADUATE CATALOG  
of  
NORTH CAROLINA  
AGRICULTURAL AND TECHNICAL  
STATE UNIVERSITY  
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**THE  
SCHOOL OF  
GRADUATE STUDIES**

**GRADUATE CATALOG**

**NORTH CAROLINA  
AGRICULTURAL AND TECHNICAL  
STATE UNIVERSITY  
GREENSBORO, NC 27411**





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## GENERAL INFORMATION

### NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

North Carolina Agricultural and Technical State University was established as the A. and M. College for the "Colored Race" by an act of the General Assembly of North Carolina ratified March 9, 1891. The act read in part: *That the leading object of the institution shall be to teach practical agriculture and the mechanic arts and such branches of learning as relate thereto, not excluding academical and classical instruction.*

The College began operation during the school year of 1890-91, before the passage of the state law creating it. This curious circumstance arose out of the fact that the Morrill Act passed by Congress in 1890 earmarked the proportionate funds to be allocated in bi-racial school systems to the two races. The A. and M. College for the White Race was established by the State Legislature in 1889 and was ready to receive its share of funds provided by the Morrill Act in the fall of 1890. Before the college could receive these funds, however, it was necessary to make provisions for Colored students. Accordingly, the Board of Trustees of the A. and M. College in Raleigh was empowered to make temporary arrangements for these students. A plan was worked out with Shaw University in Raleigh where the College operated as an annex to Shaw University during the years 1890-1891, 1891-1892, and 1892-1893.

The law of 1891 also provided that the College would be located in such city or town in the state as would make to the Board of Trustees a suitable proposition that would serve as an inducement for said location. A group of interested citizens in the City of Greensboro donated fourteen acres of land for a site and \$11,000 to aid in constructing buildings. This amount was supplemented by an appropriation of \$2,500 from the General Assembly. The first building was completed in 1893, and the College opened in Greensboro during the fall of that year.

In 1915 the name of the institution was changed to The Agricultural and Technical College of North Carolina by an Act of the State Legislature.

The scope of the college program has been enlarged to meet new demands. The General Assembly authorized the institution to grant the Master of Science degree in education and certain other fields in 1939. The first Master's degree was awarded in 1941.

The General Assembly of North Carolina voted to elevate the College to the status of a Regional University effective July 1, 1967. On October 30, 1971, the General Assembly ratified an Act to consolidate the Institutions of Higher Learning in North Carolina. Under the provisions of this Act, North Carolina Agricultural and Technical State University became a constituent institution of The University of North Carolina effective July 1, 1972.

Nine presidents/chancellors have served the Institution since it was founded in 1891. They are as follows: Dr. J. O. Crosby (1892-1896), Dr. James B. Dudley (1896-1925), Dr. F. D. Bluford (1925-1955), Dr. Warmoth T. Gibbs (1956-1960), Dr. Samuel DeWitt Proctor (1960-1964), Dr. Lewis C. Dowdy (1964-1980), Dr. Cleon F. Thompson (Interim Chancellor – 1980-1981), Dr. Edward B. Fort (1981-1999), and Dr. James C. Renick, who assumed Chancellorship responsibilities on July 15, 1999.

## NONDISCRIMINATION POLICY AND INTEGRATION STATEMENT

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY is committed to equality of educational opportunity and does not discriminate against applicants, students, or employees based on race, color, national origin, religion, gender, age, or disability. Moreover, NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY is open to people of all races and actively seeks to promote racial integration by recruiting and enrolling a larger number of white students.

NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY supports the protections available to members of its community under all applicable Federal laws, including Titles VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, Sections 799A and 845 of the Public Health Service Act, the Equal Pay and Age Discrimination Acts, the Rehabilitation Act of 1973, and Executive Order 11246.

## CODE OF STUDENT CONDUCT

Students enrolled at North Carolina Agricultural and Technical State University are expected to conduct themselves properly at all times. They are expected to observe standards of behavior and integrity that will reflect favorably upon themselves, their families, and the University. They are expected to abide by the laws of the city, state, and nation, and by all rules and regulations of the University.

Accordingly, any student who demonstrates an unwillingness to adjust to the rules and regulations that are prescribed or that may be prescribed to govern the student body will be placed on probation, suspended, or expelled from the institution.

A student may forfeit the privilege of working for the University when, for any reason, he or she is placed on probation because of misconduct. The policies and procedures governing students' conduct are located in the Student Handbook which is distributed annually.

## ADMINISTRATION, North Carolina A&T State University

James C. Renick, *Chancellor*

Carolyn W. Meyers, *Provost and Vice Chancellor for Academic Affairs*

Willie T. Ellis, Jr., *Interim Vice Chancellor for Business and Finance*

Roselle Wilson, *Interim Vice Chancellor for Student Affairs*

David W. Hoard, *Vice Chancellor for Development and University Relations*

Earnestine Psalmonds, *Vice Chancellor for Research*

Rodney E. Harrigan, *Vice Chancellor for Information Technology/CIO*

Colleen P. Grotzky, *Executive Assistant to the Chancellor*

Leslie A. Renwick, *Special Assistant to the Chancellor for Legal Affairs*

## DEANS OF COLLEGES AND SCHOOLS

Alton Thompson, *Dean, School of Agriculture and Environmental Sciences*

Phillip Carey, *Dean, College of Arts and Sciences*

Quiester Craig, *Dean, School of Business and Economics*

Lelia Vickers, *Dean, School of Education*

Joseph Monroe, *Dean, College of Engineering*

Kenneth H. Murray, *Interim Dean, School of Graduate Studies*

Patricia Price-Lea, *Dean, School of Nursing*

Elazer Barnette, *Dean, School of Technology*



## **COLLEGES, SCHOOLS, AND DIVISIONS OF NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY**

North Carolina Agricultural and Technical State University includes the following colleges, schools, and divisions: The School of Agriculture and Environmental Sciences, The College of Arts and Sciences, The School of Business and Economics, The School of Education, The School of Technology, The College of Engineering, The School of Nursing, The Graduate School, and The Division of Continuing Education and Summer School.

### **ACCREDITATION AND INSTITUTIONAL MEMBERSHIPS**

North Carolina Agricultural and Technical State University is accredited by the Commission on Colleges of the Southern Association of Colleges and Schools (1866 Southern Lane, Decatur, Georgia 30033-4097; Telephone number 404-679-4501) to award the bachelor's, master's, and doctoral degrees.

The program of Industrial Technology is accredited by the National Association of Industrial Technology.

The Media Program is accredited by the Association of Educational Communications and Technology.

The Teacher Education Programs are accredited by the National Council for Accreditation of Teacher Education.

The Department of Chemistry is accredited by the American Chemical Society.

The Social Work Programs of the Department of Sociology and Social Work is accredited by the Council on Social Work Education.

The Department Home Economics is accredited by The American Home Economics Association.

*The University holds institutional membership in the following associations:*

American Association of Colleges for Teacher Education

American Association of Collegiate Registrars and Admission Officers

National Association of State Universities and Land Grant Colleges

American College Public Relations Association

American Council for Construction Education

Associated Schools of Construction

American Council on Education

American Public Welfare Association

American Library Association

Association of American Colleges

Association of Collegiate Deans and Registrars

Association of Collegiate Schools of Architecture

American Personnel and Guidance Association

The Council of Graduate Schools

National Association of Industrial Technology, International Association of Technology Education

National Association of Student Personnel Association

Association of College Unions International

National Association of College and University Food Service

National Commission on Accrediting

National Institutional Teacher Placement Association

North Carolina Association of Colleges and Universities

North Carolina Library Association

National Association of College and University Business Officers

National Association of Business Teacher Education

American Personnel and Guidance Association

National Association of Industrial Technology, International Association of Technology Education, and the American Driver and Traffic Safety Education Association

National Association of Student Personnel Administrators

Association of College Unions International

National Association of College and University Food Service

National Commission on Accrediting

National Institutional Teacher Placement Association

Southeastern Library Association

Graduates of the University are eligible for membership in the American Association of University Women.

## ACADEMIC CALENDAR

**NOTE: This calendar is subject to periodic revision. Please check with the University Registrar to determine if changes have been made, or visit our website at [www.ncat.edu](http://www.ncat.edu).**

### North Carolina A & T State University 2001-2002 Academic Calendar

#### **FALL SEMESTER 2001**

August 13-Monday	New Freshman and Transfer Students Report
August 14-Tuesday	Orientation for New Freshman and Transfer Students
August 15-Wednesday	Advisement and Registration for New Freshman, Transfer and Readmitted Students
August 16-18 Thurs.-Sat.	<b>REGISTRATION FOR CONTINUING STUDENTS</b>
August 20-Monday	<b>CLASSES BEGIN</b>
September 3-Monday	<b>LATE REGISTRATION BEGINS</b>
September 4-Tuesday	<b>UNIVERSITY HOLIDAY (Labor Day)</b>
	<b>LAST DAY TO ADD or AUDIT A COURSE</b>
	<b>LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT</b>
	<b>LAST DAY TO APPLY FOR GRADUATION</b>
	<b>LATE REGISTRATION ENDS</b>
	<b>UNIVERSITY DAY</b>
September 15-Saturday	Grade Evaluation for Student Athletes
September 25-Tuesday	Deadline to remove Incomplete(s) received Spring and Summer 2001
October 1-Monday	<b>FALL BREAK</b>
October 8-9 Mon.-Tues.	<b>HOME COMING</b>
October 13-Saturday	Mid-term grades due for Freshmen and Student Athletes
October 16-Tuesday	Deadline to apply for Waste Management Certificates
TBA	<b>FOUNDER'S DAY (Classes are suspended from 9:30 a.m. – 12:00 Noon)</b>
November 1-Thursday	<b>LAST DAY TO DROP A COURSE WITHOUT GRADE EVALUATION</b>
	Applications for Spring semester admission to the University are due
<b>November 5</b>	Deadline for international students' applications admitted Spring 2002
November 5-14 Mon.-Wed.	<b>ADVISEMENT AND REGISTRATION</b>
November 9-Friday	Grade Evaluation for Student Athletes
November 15-Thursday	<b>LAST DAY TO WITHDRAW FROM THE UNIVERSITY WITHOUT GRADE EVALUATION</b>
November 21-Wednesday	<b>THANKSGIVING HOLIDAY begins at 1:00 p.m.</b>
November 26-Monday	<b>THANKSGIVING HOLIDAY ends at 7:00 a.m.</b>
December 7-Friday	<b>CLASSES END</b>

December 8-Saturday  
December 10-14 Mon.-Fri.  
December 15-Saturday  
December 17-Monday

**READING DAY**  
**FINAL EXAMS**  
**COMMENCEMENT**

Grades due in the Registrar's Office by 3:00 p.m.

**SPRING 2002**

January 7-Monday

Freshman and Transfer Students Report  
Faculty Report

January 9-Wednesday

Orientation for freshman and transfer students

January 10-Thursday

Advisement and Registration for New Freshman,  
Transfer and Readmitted Students

January 10-12 Thurs.-Sat.

**REGISTRATION FOR CONTINUING STUDENTS**

January 14-Monday

**CLASSES BEGIN**

January 21-Monday

**LATE REGISTRATION BEGINS**

January 28-Monday

**UNIVERSITY HOLIDAY (Martin Luther King, Jr's Birthday)**

January 29-Tuesday

Ronald E. McNair Memorial Day (classes are not cancelled)

**LAST DAY TO ADD or AUDIT A COURSE**

**LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT**

**LAST DAY TO APPLY FOR SPRING GRADUATION**

February 18-Monday

Grade Evaluation for Student Athletes

February 26-Tuesday

Deadline to remove Incomplete(s) received Fall 2001

February 28-Thursday

Deadline to apply for Waste Management Certificates

March 6-Wednesday

Mid-term grades due for Freshman and Student Athletes

March 11-16 Mon.-Sat.

**SPRING BREAK**

March 21-Thursday

**HONOR'S CONVOCATION (Classes are suspended from 9:30 a.m. – 12:00 Noon)**

March 28-Thursday

**LAST DAY TO DROP A COURSE WITHOUT GRADE**

**EVALUATION**

March 29-Friday

**UNIVERSITY HOLIDAY (Good Friday)**

April 1-10 Mon.-Wed.

**ADVISEMENT AND REGISTRATION**

April 17-Wednesday

**LAST DAY TO WITHDRAW FROM THE UNIVERSITY WITHOUT GRADE EVALUATION**

April 19-Friday

Grade Evaluation for Student Athletes

May 7-Tuesday

**CLASSES END**

May 8-Wednesday

**READING DAY**

May 9-15 Thurs.-Wed.

**FINAL EXAMS**

May 11-Saturday

**COMMENCEMENT**

May 16-Thursday

Grades due in the Registrar's Office by 2:00 p.m.



# North Carolina A & T State University

## 2002-2003 Academic Calendar

### **FALL SEMESTER 2002**

August 12-Monday	New Freshman and Transfer Students Report Faculty Meeting/Staff Institute
August 13-Tuesday	Orientation for New Freshman and Transfer Students
August 14-Wednesday	Advisement and Registration for New Freshman, Transfer and Readmitted Students
August 15-Thursday	<b>REGISTRATION FOR CONTINUING STUDENTS</b>
August 19-Monday	<b>CLASSES BEGIN</b>
September 2-Monday	<b>LATE REGISTRATION BEGINS</b>
September 3-Tuesday	<b>UNIVERSITY HOLIDAY (Labor Day)</b>
	<b>LAST DAY TO ADD or AUDIT A COURSE</b>
	<b>LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT</b>
	<b>LAST DAY TO APPLY FOR GRADUATION</b>
	<b>LATE REGISTRATION ENDS</b>
September 13-Friday	Grade Evaluation for Student Athletes
October 1-Tuesday	Deadline to remove Incomplete(s) received Spring and Summer 2001
TBA	<b>UNIVERSITY DAY</b>
October 11-Friday	Mid-term grades due for Freshmen and Student Athletes
October 14-15 Mon.-Tues.	<b>FALL BREAK</b>
TBA	<b>FOUNDER'S DAY (Classes are suspended from 9:30 a.m. – 12:00 Noon)</b>
TBA	<b>HOMECOMING</b>
October 28-Monday	<b>LAST DAY TO DROP A COURSE WITHOUT GRADE EVALUATION</b>
October 31-Thursday	Deadline to apply for Waste Management Certificate
TBA	Deadline for international students' applications admitted Spring 2003
November 4-13 Mon.-Wed.	<b>ADVISEMENT AND REGISTRATION</b>
November 7-Thursday	Grade Evaluation for Student Athletes
November 12-Tuesday	<b>LAST DAY TO WITHDRAW FROM THE UNIVERSITY WITHOUT GRADE EVALUATION</b>
TBA	Applications for Spring semester admission to the University are due
November 27-Wednesday	<b>THANKSGIVING HOLIDAY begins at 1:00 p.m.</b>
December 2-Monday	<b>THANKSGIVING HOLIDAY ends at 7:00 a.m.</b>
December 5-Thursday	<b>CLASSES END</b>
December 6-Friday	<b>READING DAY</b>
December 9-12 Mon.-Fri.	<b>FINAL EXAMS</b>
December 14-Saturday	<b>COMMENCEMENT</b>
December 16-Monday	Grades due in the Registrar's Office by 3:00 p.m.

## **SPRING 2003**

January 2-Thursday

January 3-Friday

January 3-4 Fri.-Sat.

January 6-Monday

January 20-Monday

January 22-Wednesday

January 28-Tuesday

February 10-Monday

February 18-Tuesday

February 28-Friday

March 3-Monday

March 10-15 Mon.-Sat.

March 19-Wednesday

March 20-Thursday

April 7-Monday

April 7-16 Mon.-Wed.

April 11-Friday

April 18-Friday

April 29-Tuesday

April 30-Wednesday

May 1-7 Thurs.-Wed.

May 8-Thursday

May 10-Saturday

Freshman and Transfer Students Report

Faculty Report

Orientation, Advisement and Registration for Freshman and Transfer Students

**REGISTRATION FOR CONTINUING STUDENTS**

**CLASSES BEGIN**

**LATE REGISTRATION BEGINS**

**UNIVERSITY HOLIDAY (Martin Luther King, Jr's Birthday)**

**LAST DAY TO ADD or AUDIT A COURSE**

**LAST DAY TO DROP AND RECEIVE FINANCIAL CREDIT**

**LAST DAY TO APPLY FOR SPRING GRADUATION**

Ronald E. McNair Memorial Day (classes are not cancelled)

Grade Evaluation for Student Athletes

Deadline to remove Incomplete(s) received Fall 2002

Deadline to apply for Waste Management Certificates

Mid-term grades due for Freshman and Student Athletes

**SPRING BREAK**

**LAST DAY TO DROP A COURSE WITHOUT GRADE**

**EVALUATION**

**HONOR'S CONVOCATION (Classes are suspended from 9:30 a.m. – 12:00 Noon)**

**LAST DAY TO WITHDRAW FROM THE UNIVERSITY WITHOUT GRADE EVALUATION**

**ADVISEMENT AND REGISTRATION**

Grade Evaluation for Student Athletes

**UNIVERSITY HOLIDAY (Good Friday)**

**CLASSES END**

**READING DAY**

**FINAL EXAMS**

Grades due in the Registrar's Office by 2:00 p.m.

**COMMENCEMENT**

## THE GRADUATE SCHOOL

Graduate education at North Carolina Agricultural and Technical State University was authorized by the North Carolina State Legislature in 1939. The authorization provided for training in agriculture, technology, applied sciences, and other approved areas of study. An extension of the graduate program approved by the General Assembly of North Carolina in 1957 provided for enlargement of the curriculum to include teacher education, as well as such other programs of a professional or occupational nature as might be approved by the North Carolina Board of Higher Education.

On July 1, 1967, the Legislature of North Carolina approved regional university status for the institution and renamed it North Carolina Agricultural and Technical State University. The University awarded its first master's degree in 1941 to Woodland Elroy Hall. Since that time, nearly 6,700 students have received this coveted degree of advanced studies. A significant number of these graduates have gone on to other universities to achieve the prestigious doctoral degree in their chosen disciplines. In recent years, a few students who received their master's degree from A&T remained at A&T to earn a doctoral degree from A&T's College of Engineering.

The School of Graduate Studies through its various disciplines is affiliated with the American Chemical Society, the National Council for the Accreditation of Teacher Education, the Council of Graduate Schools, the Conference of Southern Graduate Schools, the Council of Historically Black Graduate Schools, the North Carolina Conference of Graduate Schools, and other prestigious regional and national bodies. In addition, many graduate faculty members are associated with distinguished academic and professional organizations that have international acclaim and relationships.

The School of Graduate Studies has an integrated and intercultural faculty and student body and beckons students from all over the world. It coordinates and administers advanced course offerings in all departments within the School of Agriculture and Environmental Sciences, the College of Arts and Sciences, The School of Business, the School of Education, the College of Engineering, and the School of Technology. The School of Graduate Studies offers advanced study for qualified individuals who wish to improve their competency for careers in professions related to agriculture, humanities, education, science, and technology. Such study of information, techniques, and skills is provided through curricula leading to the Master of Science, the Master of Arts, the Master of Education, Master of Social Work, or the Doctor of Philosophy degree and through institutes and workshops designed for those who are not candidates for a higher degree. The School of Graduate Studies provides a foundation of knowledge and techniques for those who wish to continue their education in doctoral programs at other institutions or within this institution as it expands into the doctoral arena. While studying at this university, it is expected that graduate students (1) will acquire special competence in one or multiple fields of knowledge; (2) will develop further their ability to think independently and constructively; (3) will develop and demonstrate the ability to collect, organize, evaluate, create, and report facts that will enable them to make a scholarly contribution to knowledge about their discipline; and (4) will make new application and adaptation of existing knowledge so as to contribute to their professions and to humankind.

Eleven persons have served as dean of the School of Graduate Studies since its beginning in 1939. They are Dr. Wadran L. Kennedy (1939-1951), Dr. Frederick A. Williams (1951-1961), Dr. George C. Royal (1961-1965), Mr. J. Niel Armstrong (1965-1966), Dr. Darwin Turner (1966-1969), Dr. Albert W. Spruill, (1970-1993), Dr. Meada Gibbs (1993-1996), Dr. Charles Williams (1996-1997), Dr. Melvin N. Johnson (1997), Dr. Thoyd Melton (1998-2000), and Dr. Kenneth Murray (2000-present).

## ORGANIZATION

### School of Graduate Studies Council

The School of Graduate Studies Council is responsible for formulating all academic policies and regulations affecting graduate students, graduate courses, and graduate curricula. The council consists of faculty, students and administrative representatives from graduate programs. The Dean of the School of Graduate Studies serves as chairperson of the Council.

### Advisory Committees

Standing committees of the School of Graduate Studies are organized to advise the Council on matters pertaining to present policies, to evaluate existing and proposed programs of study, and to process student petitions relating to academic matters. These committees are as follows:

- Admission and Retention Committee
- Curriculum Committee
- Evaluation Committee
- Executive Committee
- Graduate Assistantships and Scholarships Committee
- Publications Committee
- Rules and Policy Committee

## GRADUATE ADMISSION

Applications for admission must be accompanied by the following: two official transcripts from all colleges and universities previously attended; references from at least three people who know of the student's academic record and potential for graduate study; a non-refundable application fee of \$35; and, in most cases, an official statement of the student's Graduate Record Examination or other standardized test scores. Some departments may require a letter of intent. Application and reference forms may be obtained by visiting the Website at <http://www.ncat.edu/~gradsch/> or by writing or visiting North Carolina A&T State University, School of Graduate Studies, 120 Gibbs Hall, Greensboro, NC, 27411. When completed, all application materials should be returned according to instructions. Application is made for a specific degree program and date of enrollment (see Admissions).

### Required Application Material

The admission process is designed to collect credentials that will help determine which applicants have the academic preparation, intellectual ability, experience, and motivation to undertake a rigorous program of study. The application materials for each prospective student receive individual attention and thorough review by the intended program committee. In addition to the application and application fee, the following official documents must be submitted before an application can be considered complete and submitted for evaluation by the intended program. **All material submitted as part of an application becomes a part of the University's official record and cannot be returned.**

### Letters of Recommendation

Three letters of recommendation from persons qualified to evaluate your academic and professional qualifications are required. You should request recommendations from individuals who are familiar with your academic achievement and potential. If you have been out of school for a number of years and are unable to contact your professors, letters from other in-



dividuals who can address your achievement and potential will be accepted. Please carefully complete the top section of the enclosed letter of recommendations form before giving it to the person you have selected to complete the evaluation. The recommendations should be returned to you in a sealed envelope. *Although it is extremely helpful if these letters are sent with the program material, recommendations letters can be mailed separately.* Please inform the person completing your recommendation of the appropriate application deadline so that they can submit the recommendation before the application deadline date. Note the “waiver of right to inspect” statement on these forms; you may or may not elect to sign the waiver. If you elect to sign the waiver, or do not respond at all, the contents of the reference will not be released to you.

## Transcripts

Two official transcripts of all post-secondary (after high school) education, bearing the signature of the registrar and the seal of the institution, should be sent to the School of Graduate Studies in a sealed envelope. Transcripts that bear the statement “Issued to Student,” or that do not arrive in sealed envelopes, are not considered official. International applicants must also submit a certified English translation of transcripts. The School of Graduate Studies prefers that applicants submit official transcripts with their application. However, if an institution’s registrar will only send transcripts directly to another institution, the School of Graduate Studies will accept and process transcripts separately. *Do not send transcripts directly to the intended program.* To prevent delays in review of an application, you should request transcripts before mid-year grades are posted. However, you are still responsible for assuring that a final transcript is received, showing award of the degree. Transcripts submitted to the School of Graduate Studies become part of your permanent record and cannot be re-released to another institution, employer, or you personally.

## Standardized Test (GRE, GMAT, TOEFL, etc.) Scores

Current (no more than five years old) standardized test scores, usually GRE General Test, are required for most programs. In addition to the standardized test scores mentioned above, all international applicants, except those from countries where English is the official language of instruction OR those who have received a degree from a university in the United States, must also submit an acceptable, official TOEFL score (minimum of 550 with a score of 50 in each section or comparable scores on the computer-based exam).

The School of Graduate Studies’ accreditation requires that official reports (reported directly from ETS) of all required standardized test scores be submitted as part of the application. While photocopies of score reports will be accepted for informal evaluation, an official agency report of all required scores must follow. GRE/GMAT scores are reportable for a period of five years from the date of the exam. TOEFL scores are reportable for two years from the date of the exam. The School of Graduate Studies keeps the scores for one year.

## Supplemental (Program-Specific) Application Material

Many programs require statements of purpose, supplemental applications, essays, portfolios, etc. Please check with the intended program regarding their requirements, before submitting your application. An application cannot be considered **complete** until all required material is submitted.

Because of processing requirements, an admission decision for fall semester cannot be guaranteed unless all credentials are received by **July 1**, for spring semester by **November 1**, and for summer sessions by **April 1**.

Students applying for the doctoral programs in Electrical Engineering, Industrial and Systems Engineering or Mechanical Engineering must submit their applications for the fall semester by **April 15** and for the spring semester by **October 15**. Early application is encouraged, particularly if the applicant wishes to be considered for an assistantship.

### **International Students**

Students, whose native language is other than English, regardless of citizenship, must submit TOEFL (Test of English as a Foreign Language) scores as evidence of ability to use English at a level of competence sufficient for graduate work. The minimum requirement for admission is a TOEFL score of 550 or better (213 computer-based score), with scores of 50 on at least two of the sections and no section score below 45. (Minimum score is subject to change; departments may establish a higher minimum requirement.) The test date must be within 24 months of the application deadline date before the semester for which the application is being reviewed. International applicants must have their transcripts evaluated by an external agency and have the agency forward the analysis directly to the School of Graduate Studies, 120 Gibbs Hall, North Carolina A&T State University, Greensboro, NC 27411. Academic records must be issued in the original language and be accompanied by a certified English translation. The record must bear the signature of the registrar or other academic official, and the official seal of the issuing institution. The prospective student must hold the degree of Bachelor of Arts or Bachelor of Science, or its equivalent—based on a four-year curriculum—in a foreign institution. An official score report issued by the Educational Testing Service is required. Transcripts submitted to the Graduate School become part of your permanent record and cannot be re-released to another institution, employer, or you personally. The international applicant must also provide the University with verification that the required funds are available to support the proposed program of advanced study. Foreign nationals in the United States at the time application is made must also provide information regarding their current visa status. The University provides special forms to be used by the applicant in supplying this information. (For information concerning visa, United States immigration, or the Financial Certificate, contact the Office of International Students and Scholars at (336) 334-7551.)

### **ADMISSION TO MASTER'S DEGREE PROGRAMS**

The procedures followed in evaluating an applicant's potential for success in graduate work and the criteria used for admissions decisions vary according to programs and colleges/schools and reflect an evaluation of the applicant's potential to engage in graduate work and the capability of the individual programs to accommodate additional students. Generally, requests for admission are considered by departmental admissions committees, which forward the departmental recommendations to the dean of the Graduate School.

Students are admitted to full or provisional status in a specific degree program. Admission is granted for a specific semester or summer term. Any change in the admission date must be requested in writing and approved by the department and School of Graduate Studies. Once the requirements for that degree program have been completed, no further registration as a graduate student will be permitted unless admission to a new graduate classification has been formally approved.

## **Admissions to Degree Programs**

Applicants to the Master's degree program for graduate study must have earned a bachelor's degree from a four-year college. Application forms must be submitted to the Graduate School Office with two official transcripts of previous undergraduate and graduate studies, and three letters of recommendation. Applicants may be admitted to graduate studies unconditionally, provisionally, or as a postbaccalaureate (PBS) student non-degree seeking student. Applicants are admitted without discrimination because of race, color, creed, or gender. Transcripts submitted to the Graduate School become part of your permanent record and cannot be re-released to another institution, employer, or you personally.

### **Unconditional Admission**

To qualify for unconditional admission to the master's degree program for graduate study, an applicant must have earned an over-all average of 2.6 on a 4 point system (or 1.6 on a 3 point system) in his/her undergraduate studies. Some programs require a 3.0 grade point average on a 4.0 scale; therefore, applicants should check appropriate sections of the *Graduate Catalog* to ascertain the minimum grade point average required. In addition, a student seeking a degree in Agricultural Education, Elementary Education, Technology Education, or Secondary Education must possess, or be qualified to possess, a Class A Teaching License in the area in which he/she wishes to concentrate his/her graduate studies. A student seeking a degree with a concentration in Guidance must possess, or be qualified to possess, a Class A Teaching License. See certification except for Vocational-Industrial Education (post secondary/private industry).

### **Provisional Admission**

An applicant may be admitted to the master's degree program for graduate study on a provisional basis if (1) he/she earned his/her baccalaureate degree from a non-accredited institution or (2) the record of his/her undergraduate preparation reveals deficiencies that can be removed near the beginning of his/her graduate study. A student admitted provisionally may be required to pass examinations to demonstrate his/her knowledge in specified areas, to take specified undergraduate courses to improve his/her background, or to demonstrate his/her competence for graduate work by earning no grades below "B" in his/her first nine hours of graduate work at this institution.

### **Postbaccalaureate (PBS)**

Students not seeking a to be admitted to a graduate program at A&T may be allowed to take courses for self-improvement or for renewal of teaching certificate if said students meet standard School of Graduate Studies entrance requirements. If a student subsequently wishes to pursue a degree program, he/she must complete the full admission process. The School of Graduate Studies reserves the right to refuse to accept towards a degree program credits which the candidate earned while enrolled as a PBS student; in no circumstances may the student apply towards a degree program more than twelve semester hours earned as a PBS student.

## **ADMISSION TO DOCTORAL PROGRAMS**

Applicants to doctoral programs in Electrical, Industrial and Systems, and Mechanical Engineering must submit completed application forms with two official transcripts of previous undergraduate and graduate studies and an official copy of their GRE test scores. Other admission criteria are outlined below under the following headings: unconditional admission,

provisional admission, and graduate unclassified. Transcripts submitted to the Graduate School become part of your permanent record and cannot be re-released to another institution, employer, or you personally.

## **Unconditional Admission**

Unconditional admission is offered to applicants who satisfy all general School of Graduate Studies requirements. In addition, they must have an earned Bachelor of Science and Master of Science degree in the appropriate discipline and a 3.5 grade point average in their Master of Science program. Graduate Record Examination scores are required. Test of English as a Foreign Language (TOEFL) scores are required for international students.

## **Provisional Admission**

Provisional admission is offered to applicants who meet all conditions except the 3.5 grade point average in the Master of Science degree. Provisional students must convert to unconditional admission on a timely basis by achieving a 3.5 average on graduate coursework when the ninth credit is completed.

Additionally, North Carolina A&T State University School of Technology and Indiana State University School of Technology offers jointly a doctor of philosophy consortium degree program in Technology. The specializations, program requirements, and admissions requirements are listed below.

### **Specializations are:**

- Construction Management
- Digital Communications
- Human Resource Development and Training
- Manufacturing Systems
- Quality Systems

## **Program Requirement**

The Ph.D. in Technology Management consists of a minimum of 90 hours of course work and research at the post baccalaureate level. Included is course work in a general technology core, a research core, a technical specialization, an internship, a residency requirement, and a dissertation.

## **Admission Requirements**

Admission to the program is based on students meeting the following standards. The qualitative standards identified below reflect the minimum necessary for admission but does not ensure admittance.

- Bachelor's degree from an accredited university with a minimum undergraduate grade point average of 3.0 on a 4.0 scale.
- Minimum graduate grade point average of 3.5 on a 4.0 scale.
- Graduate Record Examination minimum scores of 500 on the verbal, quantitative, and analytical general tests.
- Five letters of recommendation.
- Employer validation of 2000 hours of occupational experience related to a technical specialization.



- Written statement including reasons for selecting the program, specialization, and goals upon graduation.
- Completion and mailing of application to the School of Graduate Studies, Indiana State University or completion of the application on-line at: [www.indstate.edu/grad/applications.html](http://www.indstate.edu/grad/applications.html)

## APPLICATION

Complete applications include complete application forms, two official transcripts of all prior academic work, three letters of recommendation or reference forms, appropriate standardized test scores, a statement of residence, and a non-refundable application fee of \$35. Application forms may be obtained from the School of Graduate Studies, Room 120 Gibbs Hall, North Carolina A&T State University, Greensboro, NC 27411, or you may download an application from our website at [www.ncat.edu](http://www.ncat.edu). Transcripts submitted to the Graduate School become part of your permanent record and cannot be re-released to another institution, employer, or you personally.

Students applying for the **doctoral programs** in Electrical, Industrial and Systems, and Mechanical Engineering must submit their applications for the Fall Semester by **April 15** and for the Spring Semester by **October 15**. Early application is encouraged, particularly if the applicant wishes to be considered for an assistantship.

Exceptions to the above statements must be approved in writing by the Dean of the School of Graduate Studies.

## GRADUATE PROGRAMS REQUIRING CLASS A LICENSURE AND LICENSURE ONLY

Students applying for graduate degree programs in agricultural education, elementary education, instructional technology, technology education, and secondary education programs are required to possess or be eligible to possess the Class A license. Eligibility for the Class M (graduate-level) licensure requires an individual to possess the initial Class A licensure.

### Agricultural Education

Individuals pursuing the M.S. degree in agricultural education must satisfy requirements for the Class A licensure in agricultural education. Students who have earned some but not all undergraduate credits for agricultural education and students without the A license in the area of agricultural education should consult with the agricultural education coordinator or the chairperson in the Department of Agribusiness, Applied Economics and Agriscience Education to design a program of study that addresses requirements for the initial license. This program of study supplements the graduate requirements in this teaching specialty area. Students may be required to enroll in undergraduate courses in education and student teaching to fulfill licensure requirements.

### Elementary Education

Individuals pursuing the MAED degree in elementary education must satisfy requirements for the Class A licensure in elementary education before being admitted to the program.

### Instructional Technology

Students interested in the M.S. degree in instructional technology and the 076 (Media Coordinator), 074 (Instructional Technology Specialist-Telecommunications) and 077 (Instructional Technology Specialist-Computers) licensure must possess an initial Class A teaching

license. Individuals without this license must meet with the instructional technology coordinator or the chairperson in the Department of Curriculum and Instruction to design a Class A licensure program of study before being admitted to the program.

## **Technology Education**

Students may enter the graduate program in the area of technology education without a Class A license. The student who seeks licensure must consult with the graduate coordinator in the Department of Graphics Communication Systems and Technological Studies to design a program of study to satisfy Class A licensure requirements before being unconditionally admitted. Students may be required to enroll in undergraduate courses in education and technical options to fulfill licensure requirements. If the Class A and/or Advanced license are not sought by the student, then consultation with the graduate coordinator is necessary to determine the appropriate course of study required to satisfy the M.S. degree. A student may successfully complete the Master's degree under the supervision of the Department of Graphics Communication Systems and Technological Studies without being required to meet state licensure requirements for the Class A or Advanced licenses.

## **PROFESSIONAL EDUCATION REQUIREMENTS FOR LICENSURE**

Students who enter graduate study without the required credits in education courses and who are pursuing a teaching program in secondary education must complete a minimum of 24 semester hours which may include the following undergraduate/graduate level courses: CUIN 400, Psychological Foundations of Education; CUIN 619, Learning Theories; CUIN 625, Theory of American Public Education or CUIN 701; Philosophy of Education; CUIN 500, Principles and Curricula of Secondary Schools or CUIN 720, Curriculum Development; CUIN 624, Teaching Reading in the Secondary School; and CUIN 560, Observation and Student Teaching, or CUIN 559, Student Teaching in the Elementary School.

## **LICENSURE ONLY PROGRAMS**

Individuals may be admitted to the School of Graduate Studies for licensure (certification) only. These persons are admitted for the sole purpose of satisfying North Carolina teaching licensure requirements. Individuals must possess an earned undergraduate degree and, upon acceptance for this purpose, confer with the respective area coordinator or department chairperson to design a program of study. Students pursuing licensure only must apply for admission to the Teacher Education Program prior to pursuing the student teaching requirement. Information regarding the Teacher Education Program is available through the Office of the Dean, School of Education.

## **REGISTRATION AND RECORDS**

Each student is responsible for informing knowing and understanding the academic regulations and requirements set forth in this Catalog and for revisions of same as posted on campus bulletin boards or released in other official publications of the University. Lack of knowledge of regulations and requirements does not excuse the student from complying with the academic regulations and meeting the requirements.

A student's program of study must be approved by his/her advisor, his/her chairperson, and members of the faculty advisor committee in his/her major department at registration. Advisors will make every attempt to give effective guidance to students in academic matters and to



refer students to those qualified to help them in other matters. However, the final responsibility for meeting all academic requirements for a selected program rests with the student.

## **Courses of Study**

A student should refer to the requirements of his/her respective department or school for his/her program of study and confer with his/her advisor whenever problems arise. The student is expected to follow the program of academic work outlined as closely as possible.

## **Official Registration**

Registration is a time designated each semester to allow the student and his/her advisor to review the student's records and plan a program for the next semester.

The student has an opportunity to discuss academic problems with the advisor. Registration helps to ensure that the courses requested on the registered schedule will be available to the student the following semester.

Any student who is enrolled in the University during the registration period is expected to register during the period designated for this purpose.

In order for a student to get credit for a course, he/she must be properly registered in that course. This means that the student must have gone through the registration procedures as outlined by the University. Further, the student must have paid all required tuition and fees.

## **Late Registration**

A student is expected to complete enrollment (including the payment of all required fees) on the dates listed on the University Calendar. The payment of fees is part of the registration process. No student is eligible to attend classes until the required fees have been paid.

A student who fails to complete registration during the scheduled dates will be required to pay a late registration fee of \$20.00 beginning on the date specified in the University Calendar and \$10.00 each day during the late registration period until the bill is validated.

## **Course Load**

A full-time graduate course load is 9 to 15 credits per semester (including audits) and 3-6 credits per summer session (including audits). Audits in subjects in which the student has no previous experience will be evaluated at full credit value in determining course load. Audits taken as repetition of work previously accomplished are considered at one half of their value in calculating course loads. With the single exception of foreign language audits, all audit registrations must fall within the range of maximum permissible course loads. The maximum load is 15 semester hours.

Foreign students on F-1 and J-1 visas are required by the Immigration and Naturalization Service to carry a full-time course of study to remain in status.

## **University Staff**

The maximum load for any fully employed member of the University faculty or staff will be six semester hours for the academic year.

## **Concurrent Registration In Other Institutions**

A student registered in a degree program in the School of Graduate Studies may not enroll concurrently in another graduate school except upon permission, *secured in advance*, from the Dean of the School of Graduate Studies.

## Grading Policies

Grades for graduate students are recorded as follows: A, excellent; B, average; C, below average; F, failure; S, work in progress (for courses in research); I, incomplete; W, withdrawal.

1. In order to earn a degree, a student must have a cumulative average of "B" (a grade point average of 3.0 on a system in which 1 hour of "A" earns 4 grade points).
2. A graduate student automatically goes on probation when his/her cumulative average falls below "B."
3. A student may be dropped from the degree program if he/she has not been removed from probation after two successive terms as a full-time student.
4. A student may not repeat a required course in which "C" or above was earned.
5. A student may repeat a required course in which "F" was earned. A student may not repeat the course more than once. If a student fails a second time, he/she is dismissed from the degree program.
6. All hours attempted in graduate courses and all grade points earned are included in the computation of the cumulative average of a graduate student.
7. A student who stops attending a course but fails to withdraw officially may be assigned a grade of "F."
8. All grades of "I" must be removed during the student's next term of enrollment.
9. A student may not count towards a degree program any course in which a grade of "F" was earned.

***NOTE: The North Carolina Department of Public Instruction does not accept courses in which a student has received a "D" or "F" for renewal of certification.***

## Audit

A regular student may audit a course by picking up the Audit Form from the Office of the Registrar. He/she must register officially for the course and pay the University Cashier.

Attendance, preparation, and participation in the classroom discussion and laboratory exercises shall be at the discretion of the instructor.

A student who audits courses is not required to take examinations or tests and he/she receives no credit. An auditor may not change his/her registration from audit to credit or from credit to audit after late registration ends.

## Change of Grade

A request for a change of grade, for any reason, must be made within one year following the date the original grade was assigned by the faculty member.

## Grade Appeal

A student may appeal the final grade earned in a course. Initially, the student should attempt to resolve the matter informally through meeting with the instructor of the course, the department chairperson, and/or dean of the academic unit in which the grade was assigned. If the matter is not resolved through this level of interaction, then the student should consult the individual school/college on its written grade appeal policy. A student wishing to pursue a written appeal of a grade must demonstrate a legitimate basis for the appeal. Grade appeal decisions are final at the level of the school/college.

## **Academic Warning, Probation, and Dismissal**

A cumulative grade point average of 3.0 (B) is required for graduation. A department shall recommend courses in which the grades of "B" or better will be required. A student who accumulates more than nine semester hours of grades below "B" shall be dismissed from the School of Graduate Studies. When a student's grade point average (GPA) falls below 3.0, he/she will be warned and informed that he/she must raise the GPA to 3.0 in the next two terms in residence. Students failing to do so will be dismissed from the School of Graduate Studies and no further registration in a graduate classification will be permitted. Upon extenuating circumstances the student can be reinstated upon the written recommendation of the department and approval by the Graduate Dean.

Graduate-level courses with a grade of "D" or lower are not acceptable in a program of study, following admission to degree-seeking status. In addition, graduate transfer courses with a grade of "C" or lower are not acceptable in the program of study. See section on Grading Policies.

## **Eligibility for Assistantship**

A graduate student must be in good academic standing (3.0 GPA or better average) to be eligible for appointment to an assistantship, fellowship, scholarship or traineeship, and must be registered in each semester in which the appointment is in effect.

## **Changing Programs**

A students may transfer from one School/College of the University to another with the written approval and acceptance of the deans of the Schools/Colleges involved. The proper forms on which to apply for such a change are to be obtained from the Graduate Studies Office and executed at least six weeks prior to the beginning of the semester in which the student plans to transfer. When such a transfer is made, the student must satisfy the current academic requirements of the School/College and/or department into which the student has transferred.

## **Withdrawal from the University**

A student who wishes or is asked to leave the University at any time during the semester shall execute and file official withdrawal forms. These forms may be obtained from the University Counseling and Testing Center. They should be completed and submitted to the Office of the Registrar.

A student who withdraws from the University within 15 calendar days of the beginning of the final examination period for the semester shall receive a "W" in all classes enrolled. Failure to execute and file these forms in a timely manner will result in a student receiving an "F" for each course in which he or she was enrolled during the semester in question.

## **Incompletes**

A student is expected to complete all requirements of a particular course during the semester in which he/she is registered. However, if at the end of the semester a small portion of the work remains unfinished and should be deferred because of some serious circumstances beyond the control of the student, an "I" may be submitted.

An "I" for a prolonged illness may be submitted only after the written approval of the Vice Chancellor for Student Affairs has been secured. An "I" for other causes may be submitted only with the approval of the Dean of the School of Graduate Studies.

Along with the recording of the incomplete grade, the instructor must also file with the chairperson of the department the student's average grade and a written description of the work that must be completed before the incomplete is removed.

## **Procedure for the Removal of an Incomplete**

An incomplete grade must be removed within SIX WEEKS after the beginning of the next semester. If the student has not removed the incomplete within the time specified, the Incomplete is automatically changed to an "F." Developmental, thesis, and research courses are exempted from the six-week time limit.

## **Continuous Registration**

After a student is admitted to the School of Graduate Studies and enrolls for the first time, she/he is required to maintain continuous registration, i.e., be enrolled each semester, excluding summer sessions, until he/she has either graduated or her/his graduate program at North Carolina A&T State University has been terminated. All students must be registered the semester or summer session in which they formally complete their degree requirements.

A student in good academic standing who must interrupt his/her graduate program for good reasons may request a leave of absence from graduate study for a definite period of time, normally not to exceed one year. The request should be made at least one month prior to the term involved. Upon endorsement of the request by the student's graduate advisory committee and Director of Graduate Programs, and approval by the Graduate School, the student will not be required to be registered during the leave of absence. The time that the student spends on an approved leave of absence will be included in the time allowed to complete the degree, i.e., six years for master's and ten years for doctoral.

Graduate students whose programs have been terminated because of failure to maintain continuous registration and who have not been granted a leave of absence during a fall or spring semester will be required to reapply for admission if they wish to resume their graduate studies at North Carolina A&T State University.

## **Changes in Schedule**

A change in a student's program may be made with the consent of his/her advisor or department chairperson. However, if a student's schedule is changed after the designated drop-add period, the consent of the Dean of School of Graduate Studies is required.

The student must obtain and properly execute the Change of Schedule Form. This form is obtained from the Office of the Registrar and should be returned to that office.

## **Class Attendance Policy**

### *Class Attendance*

The University is committed to the principle that regular and punctual class attendance is essential to the student's optimum scholastic achievement. An absence, excused or unexcused, does not relieve the student of any course requirement. Regular class attendance is a student's obligation, and a student is responsible for all the work, including tests and written work requested or assigned during all class meetings.

### *Instructor's Responsibility*

- 1) Description of attendance requirements should be stated in the course syllabus and announced in class, particularly at the beginning of each term. If class attendance is to



affect a student's course grade, then a statement to that effect must be a part of the course syllabus distributed to each student.

- 2) Instructors will keep attendance records in all classes. Each instructor has the right to prescribe procedures as to how and when attendance will be taken.

### *Student's Responsibility*

It is the responsibility of each student to learn and comply with the requirements set by the instructor for each class in which he/she is registered. The student should

- 1) have knowledge of each instructor's attendance and monitoring practices for class absences during the term.
- 2) become familiar with all materials covered in each course during absences, and make-up any work required by the instructor.
- 3) initiate the request to make-up work on the first day of class attendance after the absence.

### *Policy on Make-Up of Required Course Work*

The administration, faculty, and staff recognize that there are circumstances and events which require students to miss classes and the required course work which may be performed or required on the day of the absence. Also, they recognize that required course work is needed to give each student an adequate performance evaluation. Therefore, whenever reasonable (and more specifically described below), students should be allowed to make up required work.

The following definitions will apply with respect to this policy:

- a) Required course work—All work which will be used in the determination of final grades, e.g., examinations, announced quizzes, required papers and essays, required assignments.
- b) Instructor—Person responsible for the course and providing instruction and evaluation.
- c) Permissible reasons for requesting make-up of required work are: Sickness (verification needed); death of relatives (immediate family); participation in approved University related activities; or acting in the capacity of a representative of the University (band, choir, sports related travel, etc.). Extraordinary circumstances (court appearance, family emergency, etc.)—require a signed statement. NOTE: Other reasons for requesting make-up of required course work are not acceptable.

### **Grade Reports**

As soon as grades are determined, at the end of each semester or summer term, a report of grades is sent to the student at his/her permanent home address.

### **Privacy of Student Records**

The University ensures students access to their official academic records but prohibits the release of personally identifiable information, other than "directory information," from these records without their permission, except as specified by public law 93-380. "Directory information" includes the following: Student's name, address, telephone number, date and place of birth, school, major, sex, marital status, dates of attendance, degree received, honors received, institution(s) attended prior to admission to North Carolina Agricultural and Technical State University, past and present participation in officially recognized sports and activities, and physical factors. Public Law 93-380 further provides that any student may, upon written re-

quest, restrict the printing of such personal information relating to himself or herself as is usually included in campus directories. A student who desires to have "directory information" withheld must submit a written request to the Office of the Registrar one week before the beginning of classes for the semester or session in which he/she is enrolled.

### **Access To Student Records**

1. The policy for the administration of student academic records is in accordance with the Family Educational Rights and Privacy Act of 1974 as amended.
2. A student has the right to inspect and review any and all official records, files, and data directly related to him/her.
3. A student who believes that his/her record contains inaccurate or misleading information shall have an opportunity for a hearing to challenge the content of the record to ensure that the record is not inaccurate, misleading, or otherwise in violation of his/her privacy or rights, and to provide an opportunity for the correction or deletion of any such inaccurate, misleading, or otherwise inappropriate data contained therein or for the inclusion of the student's own statement of explanation.
4. The University will comply with a request from a student to review his/her record within a reasonable period of time and not later than thirty (30) days after the request is received.
5. The release of academic records requires the written permission of the student, except as provided by Public Law 93-380. Transcripts are not issued to a student who has not met his/her financial obligations to the University.
6. Copies of the "University's Statement" concerning access to students' records are available in the Office of the Registrar, as well as the office of each school/college dean and department chairperson.

### **Change of Name and Address**

It is the obligation of every student to notify the Office of the Registrar of any change in name or address. Failure to do so can cause serious delay in the handling of the student's records and in notification of emergencies at home. ***A legal court document must accompany the request to change the student's name.***

### **Transcripts of Records**

Requests for official or unofficial transcripts of students' records should be addressed to the University Registrar. The cost is \$2.00 per copy.

### **Indebtedness to the University**

No diploma, certificate, or transcript of a record will be issued to a student who has not made a satisfactory settlement with the cashier for all indebtedness to the University. A student may not be permitted to attend classes or take final examinations after the due date of any unpaid obligation.

### **Academic Dishonesty Policy**

North Carolina A&T State University is committed to a policy of academic honesty for all students. Examples of Academic Dishonesty include but are not limited to the following:

- Cheating or knowingly assisting another student in committing an act of academic dishonesty.



- Plagiarism (unauthorized use of another person's words or ideas as one's own) which includes but is not necessarily limited to submitting examinations, theses, reports, drawings, laboratory notes, or other materials as one's own work when such work has been prepared by another person or copied from another person.
- Unauthorized possession of examinations or reserve library materials, destruction or hiding of source materials, library materials, or laboratory materials, or experiments, or any other similar action.
- Unauthorized changing of grades or marking on an examination or in an instructor's grade book, or such change of any grade record.
- Aiding or abetting in the infraction of any of the provisions anticipated under the general standards of student conduct.
- Assisting another student in violating any of the above rules.

A student who has committed an act of academic dishonesty has failed to meet a basic requirement of satisfactory academic performance. Thus, academic dishonesty is not only a basis for disciplinary action but may also affect the evaluation of the student's level of performance. Any student who commits an act of academic dishonesty is subject to disciplinary action as defined below.

In instances where a student has clearly been identified as having committed an academic act of dishonesty, the instructor may take appropriate punitive action including a loss of credit for an assignment, an examination or project, or awarding a grade of "F" for the course subject to the review and endorsement of the chairperson and the dean. Repeated offenses can even lead to dismissal from the University.

## **Student Appeals on Academic Dishonesty**

A student who feels unfairly treated as a result of an academic dishonesty matter may appeal the action in writing to the University Judicial Tribunal. The written notice of appeal must be submitted within one week (seven calendar days) of the date of the incident. The student should refer to the section on Appellate Procedures in the Student Handbook.

## **Graduation**

There are four official graduations (June, August, December and May) for graduate students per year, occurring at the end of the fall and spring semesters and at the end of the second summer session. Formal commencement exercises are held at the end of the spring and fall semesters, but any student who graduated the preceding second summer session is eligible to participate in the December Commencement. Any doctoral candidate wishing to have the degree conferred *in absentia* must notify the Graduate School in writing; master's candidates should contact their departments or programs.

## TUITION AND FEES

The fee charged to a full-time student carrying nine or more semester hours of work is the same as that charged to a full-time undergraduate student. For one academic year, a state resident should expect to pay approximately \$2,306.00, which will cover tuition and required fees; this sum does not include room and board charges. Tuition and required fees for an out-of-state student carrying a full schedule will total \$9,576.00 for the academic year. Current room and board rates are \$2,235.00 per semester.

As student fees are subject to change without prior notice, it is advised that the Treasurer's Office be contacted for complete information concerning charges for full-time and part-time students.

### Special Fees

Fee for processing application	\$35.00
Late Registration	20.00
Graduation fees:	
Diploma	35.00
Regalia ( <i>cap and gown</i> )	20.00
Transcript	2.00
Master's Thesis and Dissertation binding fee	48.00

## EXPENSES AND FINANCIAL AID

### General Information

NORTH CAROLINA A&T STATE UNIVERSITY IS A PUBLICLY SUPPORTED INSTITUTION. TUITION PAYMENTS AND OTHER REQUIRED STUDENT FEES MEET ONLY A PART OF THE TOTAL COST OF THE EDUCATION OF STUDENTS ENROLLED. ON THE AVERAGE, FOR EACH FULL-TIME STUDENT ENROLLED IN AN INSTITUTION OF THE UNIVERSITY OF NORTH CAROLINA, THE STATE OF NORTH CAROLINA APPROPRIATED \$8,735 PER YEAR IN PUBLIC FUNDS TO SUPPORT THE EDUCATIONAL PROGRAMS OFFERED.

THE UNIVERSITY RESERVES THE RIGHT TO INCREASE OR DECREASE ALL FEES AND CHARGES AS WELL AS ADD OR DELETE ITEMS OF EXPENSE WITHOUT ADVANCE NOTICE AS CIRCUMSTANCES, IN THE JUDGMENT OF THE ADMINISTRATION, MAY REQUIRE.

Boarding and Lodging fees are based on the actual number of days school is in session and do not include holidays, breaks, or any other University vacations.

Students' property in dormitories and other University buildings is at the sole risk of the owner, and the University is not responsible for loss, theft, or damage to such property arising from any cause.

Students are required to pay for any loss or damage to University property at replacement cost due to abuse, negligence, or malicious action, in addition to being subject to disciplinary action.

All undergraduate and graduate students are required to purchase all textbooks. This includes hardcover and paperback textbooks. The cost will vary according to academic discipline. Other policies and procedures governing the book-purchase system can be obtained from the University Bookstore.

Personal spending money should be sent directly to and made payable to the student in the form of money orders or certified checks. As a policy, the University does not cash personal checks for students in any amount.

Diplomas and transcripts are withheld until the student has paid in full all fees and charges due the University. A student in debt to the University in any amount will not be permitted to enroll for any subsequent semester until his or her obligations are paid. If special financial arrangements have been made, failure to comply with these arrangements as stipulated will result in the student being withdrawn from the University for nonpayment of required fees.

### **Special Notice to Veterans**

Veterans attending school under the provisions of Public Law 89-358 receive a monthly subsistence allowance from the Veterans Administration. Therefore, veterans are responsible for meeting all of their required fee obligations.

Veterans attending school under the provision of Public Law 894 (Disabled Veterans) receive a monthly subsistence allowance from the Veterans Administration. Also, the Veterans Administration pays directly to the school the cost of the veteran's tuition and required fees. All other fees are the responsibility of the veteran.

Veterans may contact the Veterans Affairs Office on Campus for any special consideration which may be available.

### **Auditing**

To audit a course, a student must obtain permission from the Dean of the School of Graduate Studies and must submit the necessary forms during the registration period. A part-time student must pay all fees, including tuition, that would be charged to a student taking the course for credit. A full-time student is not required to pay any additional fees for auditing. A change from credit registration to audit will not be permitted after late registration ends. An auditor is not required to participate in class discussions, prepare assignments, or take examinations.

### **Full-Time Faculty and Employees**

Full-time employees of the University who hold membership in the Teachers' and State Employees' Retirement System may register for credit or as auditors with free tuition privileges for one course in any academic term at any campus of the University of North Carolina. Free tuition privileges do not apply during the summer. Each applicant for free tuition must submit through regular channels a form provided by the University.

### **Refund Policy**

Refunds for official withdrawals from North Carolina A&T State University are prorated, based upon the percentage of the enrollment period attended. No refunds are made for official withdrawals after the fifth week of the enrollment period. The prorated withdrawal schedule is publicized in the schedule of classes booklet and through other University media.

### **Residence Status for Tuition Purposes**

The basis for determining the appropriate tuition charge rests upon whether a student is a resident or a nonresident for tuition purposes. Each student must make a statement as to the length of his or her residence in North Carolina, with assessment by the institution of that statement to be conditioned by the following.

**Residence.** To qualify as a resident for tuition purposes, a person must become a legal resident and remain a legal resident for at least twelve months immediately prior to classification. Thus, there is a distinction between legal residence and residence for tuition purposes. Furthermore, twelve months legal residence means more than simple abode in North Carolina. In particular, it means maintaining a domicile (permanent home of indefinite duration) as opposed to "maintaining a mere temporary residence or abode incident to enrollment in an institution of higher education." The burden of establishing facts which justify classification of a student as a resident entitled to in-state tuition rates is on the applicant, who must show his or her entitlement by the preponderance (the greater part) of the residuary information.

**Initiative.** Being classified a resident for tuition purposes is contingent on the student's seeking such status and providing all information that the institution may require in making the determination.

**Parents' Domicile.** If an individual, irrespective of age, has living parents(s) or court-appointed guardian of the person, the domicile of such parent(s) or guardian is, prima facie, the domicile of the individual; but this prima facie evidence of the individual's domicile may or may not be sustained by other information. Further, no domiciliary status of parents is not deemed prima facie evidence of the applicant child's status if the applicant has lived (though not necessarily legally resided) in North Carolina for the five years preceding enrollment or re-registration.

**Effect of Marriage.** Marriage alone does not prevent a person from becoming or continuing to be a resident for tuition purposes, nor does marriage in any circumstance ensure that a person will become or continue to be a resident for tuition purposes. Marriage and the legal residence of one's spouse are, however, relevant information in determining residuary intent. Furthermore, if both a husband and his wife are legal residents of North Carolina and if one of them has been a legal resident longer than the other, then the longer duration may be claimed by either spouse in meeting the twelve-month requirement for in-state tuition status.

**Military Personnel.** A North Carolinian who serves outside the State in the armed forces does not lose North Carolina domicile simply by reason of such service. And students from the military may prove retention or establishment of residence by reference, as in other cases, to residuary acts accompanied by residuary intent.

In addition, a separate North Carolina statute affords tuition rate benefits to certain military personnel and their dependents even though not qualifying for the in-state tuition rate by reason of twelve months legal residence in North Carolina. Members of the armed services, while stationed in and concurrently living in North Carolina, may be charged a tuition rate lower than the out-of-state tuition rate to the extent that the total of entitlements for application tuition costs available from the federal government, plus certain amounts based under a statutory formula upon the in-state tuition rate, is a sum less than the out-of-state tuition rate for the pertinent enrollment. A dependent relative of a service member stationed in North Carolina is eligible to be charged the in-state tuition rate while the dependent relative is living in North Carolina with the service member and if the dependent relative has met any requirement of the Selective Service System applicable to the dependent relative. These tuition benefits may be enjoyed only if the applicable requirements for admission have been met; these benefits alone do not provide the basis for receiving those derivative benefits under the provisions of the residence classification status reviewed elsewhere in this summary.

**Grace Period.** If a person (1) has been a bona fide legal resident, (2) has consequently been classified a resident for tuition purposes, and (3) has subsequently lost North Carolina legal residence while enrolled at a public institution of higher education, that person may continue to enjoy the in-state tuition rate for a grace period of twelve months measured from the date



on which North Carolina legal residence was lost. If the twelve months ends during an academic term for which the person is enrolled at a State institution of higher education, the grace period extends, in addition, to the end of that term. The fact of marriage to one who continues domiciled outside North Carolina does not by itself cause loss of legal residence marking the beginning of the grace period.

**Minors.** Minors (persons under 18 years of age) usually have the domicile of their parents, but certain special cases are recognized by the residence classification statute in determining residence for tuition purposes.

(a) If a minor's parents live apart, the minor's domicile is deemed to be North Carolina for the time period(s) that either parent, as a North Carolina legal resident, may claim and does claim the minor as a tax dependent, even if other law or judicial act assigns the minor's domicile outside North Carolina. A minor thus deemed to be a legal resident will not, upon achieving majority before enrolling at an institution of higher education, lose North Carolina legal residence if that person (1) upon becoming an adult "acts, to the extent that the person's degree of actual emancipation permits, in a manner consistent with bona fide legal residence in North Carolina" and (2) "begins enrollment at an institution of higher education not later than the fall academic term following completion of education prerequisite to admission at such institution."

(b) If a minor has lived for five or more consecutive years with relatives (other than parents) who are domiciled in North Carolina and if the relatives have functioned during this time as if they were personal guardians, the minor will be deemed a resident for tuition purposes for an enrolled term commencing immediately after at least five years in which these circumstances have existed. If under this consideration a minor is deemed to be a resident for tuition purposes immediately prior to his or her eighteenth birthday, that person on achieving majority will be deemed a legal resident of North Carolina of at least twelve months duration. This provision acts to confer in-state tuition status even in the face of other provisions of law to the contrary; however, a person deemed a resident of twelve months duration pursuant to this provision continues to be a legal resident of the State only so long as he or she does not abandon North Carolina domicile.

**Lost but Regained Domicile.** If a student ceases enrollment at or graduates from an institution of higher education while classified a resident for tuition purposes and then both abandons and reacquires North Carolina domicile within a 12-month period, that person, if he or she continues to maintain the reacquired domicile into re-enrollment at an institution of higher education, may re-enroll at the in-state tuition rate without having to meet the usual twelve-month durational requirement. However, any one person may receive the benefit of the provision only once.

**Change of Status.** A student admitted to initial enrollment in an institution (or permitted to re-enroll following an absence from the institutional program which involved a formal withdrawal from enrollment) must be classified by the admitting institution either as a resident or as a nonresident for tuition purposes prior to actual enrollment. A residence status classification once assigned (and finalized pursuant to any appeal properly taken) may be changed thereafter (with corresponding change in billing rates) only at intervals corresponding with the established primary divisions of the academic year.

**Transfer Students.** When a student transfers from one North Carolina public institution of higher education to another, he or she is treated as a new student by the institution to which he or she is transferring and must be assigned an initial residence status classification for tuition purposes.

## Financial Support for Graduate Students

Financial aid is money awarded to assist students in paying for the cost of an education. Applying and receiving financial aid is a simple process. Students apply for need based and some non-need based financial aid by completing the Free Application for Federal Student Aid (FAFSA). Students should complete this form immediately after January 1. There is no processing fee and all graduate students are encouraged to complete the application. Students can submit the FAFSA on the Web (<http://www.fafsa.ed.gov>) or mail the form to the Federal Processing Center. North Carolina A&T State University school code is **002905**. The University's priority deadline is **March 15**; however, students who miss the deadline are still encouraged to complete and mail the FAFSA.

A financial aid award will not be offered until a student is admitted to the University. Therefore, it is important that the admission procedure be completed as soon as possible.

A student enrolled as a "Postbaccalaureate Studies (PBS)" student is not eligible to receive Federal and State financial aid. The student must petition the Dean of Graduate Studies to have his/her status reviewed and changed, if applicable.

All students must re-apply for financial assistance each academic year and separately for summer school.

### Types of Available Funds

Graduate students are eligible for Assistantships, Stipends, Scholarships, Work, Loans and some Grants. Work assistance must be earned and loans must be repaid.

### Graduate Assistantship

A limited number of graduate assistantships are available to qualified individuals. The student is assigned to assist a professor or a department for a limited number of hours for the duration of the assistantship. Some graduate assistants are assigned to teach freshman classes. Normally, a graduate assistant will be assigned to teach only one class per semester, but he/she may be assigned to teach a maximum of two classes. The assistantship offers a stipend that will assist a student to pay required tuition, fees, books, and room and board. Application for an assistantship must be made to the Dean of the School of Graduate Studies at least five months before fall registration. Only full-time graduate students are eligible.

### Stipends

Stipends are considered a resource for financial aid purposes. If the student receives stipend assistance, the amount may affect eligibility for federal financial assistance.

**Course Work** – Masters' and Doctoral students must enroll in at least half time (**5 hours**) of **graduate course work (600 or 700 course level)** to be eligible for a Federal Direct Student Loan. The University considers 9 hours to be full-time; therefore, half-time would be 5 hours. Financial aid for Graduate students will not cover undergraduate courses taken.

### Scholarships

The majority of scholarships at NC A&T State University are awarded through the academic department. Students are strongly urged to contact their academic department for additional scholarship information. Students receiving an outside scholarship should forward a copy of the notice to the Student Financial Aid Office. The scholarship will be included in the student's award and may cause an adjustment to the current award package. All scholarship



checks should be made payable to North Carolina A&T State University and mailed to the Treasurer's Office. The check should include the student's name and social security number.

Students are encouraged to search for scholarships via the internet (<http://www.finaid.org>) or the library. Students should be careful of companies who offer to locate scholarships for a fee.

Additional scholarship information for graduate students can be obtained by visiting the North Carolina State Education Assistance Authority web site at (<http://www.ncseaa.edu>).

## **Federal Work Study**

Federal Work-Study is available to eligible students. Job assignments are available to graduate students with financial need. The Federal Work-Study Program provides students the opportunity to earn part of their educational expenses and to gain valuable work experience for future reference. The total amount of the award is listed on the award notification. Students who are awarded Federal Work-Study must pick up an assignment form from the Student Financial Aid Office at the beginning of the Fall semester. Students cannot begin work until an authorization is received and returned to the Student Financial Aid Office. Students should report back to the assigned department in the Spring semester. To ensure that the award amount is not exceeded, students are encouraged not to work more than 15 hours per week. The Student Financial Aid Office is not responsible for paying hours which exceed the award amount. Students working on campus are paid monthly, normally, on the 15th of each month. It is the student's and supervisor's responsibility to ensure that the award amount is not exceeded. Time sheets are due in the Student Financial Aid Office monthly in order for the student to be paid. Time sheets received after the due date will be held until the next payroll. Checks are distributed from the Treasurer's Office. The Federal Work-Study award cannot be used toward payment of University fees at registration.

## **Grants**

Minority Presence funds are awarded to the University from the State of North Carolina to recruit North Carolina residents who are minority (white) students. The University awards up to \$600 for the academic year. The student must take at least three hours of degree-credit coursework per semester. Applications may be obtained from the Admissions Office.

## **Loans**

The Student Financial Aid Office awards funds through the Federal Direct Loan Program to Graduate Students. This is a loan and must be repaid with interest. There are two types of Federal Direct loans. Subsidized Loans are based on financial need and the government pays the interest on the student's behalf as long as the student is attending school at least half-time (5 or more hours per semester). The student is responsible for the interest payments on an unsubsidized loan. The interest is billed quarterly, after the second disbursement. Students can allow the interest to be capitalized and added to the principal, if payment cannot be made. Students must sign a promissory note. Promissory notes are signed via the web. Students are encouraged to borrow the minimum loan amount. If this is the student's first time borrowing at NC A&T State University, the borrower must attend an entrance counseling session before the first disbursement is made. Students should review the promissory note for the expected disbursement dates. Loan funds will be applied to the student's account within five days of the disbursement date. The loan is disbursed in two payments. The Spring disbursement will occur

10 days before the first day of Spring semester classes. Generally, refunds are available from the Treasurer's Office five to seven days after the loan is applied to the account.

Students are notified of the amount of aid received through the award notification. The award notification indicates the gross amount of the loan for the fall and spring semester and/or summer sessions. The student's account and bill indicates the actual amount received. Students have the right to cancel all or part of the loan. Students interested in canceling or reducing the loan, must notify the Student Financial Aid Office in writing. The correspondence must be received in the Student Financial Aid Office within 14 days from the date of the bill; otherwise, the loan will remain on the student's account. If the loan is canceled, the student is responsible for any outstanding account balance.

**Adjustment to an Award** – Financial aid budgets and awards will be adjusted for graduate students enrolled less than 9 hours. Adjustments will be based on the hours enrolled as of the census date. If adjustments are made and the student has received a refund, the student will be responsible for any balance due the University.

**Teacher Certification** – Students working on Teaching Certification only are eligible to receive a Federal Direct Student Loan provided the student is enrolled in at least six (6) credit hours. The loan can only be awarded at the undergraduate fifth year level. Students can only borrow at the fifth grade level only twice. Students cannot exceed the maximum loan amount as an undergraduate student. Students can only receive financial aid once for Teacher Certification or Licensure Only Classes. Financial aid will only pay for the class once.

## **Summer School**

Students interested in attending Summer School must complete a separate application and have a current year FAFSA on file. Graduate students generally receive only the Federal Direct Student Loan, if there is remaining eligibility. All students must attend the First Summer Session to be eligible for a Direct Loan. A student must enroll in at least 5 credit hours (half-time) to receive loan assistance. Students who are not maintaining Satisfactory Academic Progress should attend summer school to remove the deficiency, but will not be eligible for financial assistance.

## **SATISFACTORY ACADEMIC PROGRESS**

### ***GRADUATE ELIGIBILITY\****

To be in compliance with the Satisfactory Academic Progress standards, graduate students must meet the following requirements to continue receipt of financial aid.:

- A. They must have a cumulative grade point average (GPA) of 3.0 or better at the end of each academic year.
- B. If they are full-time graduate students, they must earn 9 hours each semester.
- C. If they are less than full-time graduate students, they must complete, with passing grades, at least 80% of the total number of hours attempted for the academic year.
- D. They must not exceed 54 attempted hours. Majors in Counseling Education, Agency Counseling and Business and Industry must not exceed 90 attempted hours.
- E. They must not exceed six semesters of full-time enrollment (full-time is 9 or more hrs.)

Failure to earn the required hours and/or grade point average will result in the student being suspended from financial aid. Students can attend summer school to make up the deficiency; however, the student is responsible for payment of charges.

Additional information on financial aid programs can be obtained from the University Bulletin, the Financial Aid Handbook, the Federal Work-Study Handbook and the University web site (<http://www.ncat.edu>).

### Immunization for Graduate Students

All full-time graduate students admitted to a degree program are required by State Law to submit a report of medical history and immunization documentation prior to completing their initial registration. North Carolina A&T State University students returning to School of Graduate Studies must have their medical history file updated. The required immunizations must be submitted to the student health center before registration for classes. If this requirement is not met dismissal from school is mandatory under state law. Students taking evening (after 6:00 p.m.) and weekend classes are not required to submit immunizations. The following immunizations are required by state law and are offered at the Student Health Center for the following cost:

<b>Tetanus (within ten years)</b>	.....	<b>\$10.00</b>
<b>MMR (measles, mumps, rubella)</b>	— 1 vaccine for students 30 years and older,	
	— 2 vaccines for students under age 30 .....	<b>\$10.00</b>
<b>Tuberculin skin test for international students</b>	.....	<b>\$ 5.00</b>
<b>GRADUATE STUDENTS ARE NOT REQUIRED TO HAVE A PHYSICAL EXAMINATION.</b>		

For new students who have been accepted, please complete the medical history form enclosed in your graduate packet, and return it to:

Sebastian Health Center  
North Carolina A&T State University  
Greensboro, North Carolina 27411

Attention: Medical Records

### Health Services

The Sebastian Student Health Center is managed by a Director of Health Services. Medical services are available to all students in the Student Health Center if they have paid the student health fee as part of their general University fee.

The basic components of the Health Service Program are as follows:

1. **Medical Services:** The University Physicians are in attendance in the Health Center daily (hours for routine treatment are posted) — and on 24-hour call for any emergency situations.
2. **Nursing Services:** Registered nurses, under the direction of a Head Nurse, are in attendance daily to treat and evaluate students' health needs and answer any questions pertaining to health problems and other concerns.
3. **Laboratory Services:** A Certified Medical Technologist is on duty - Friday to perform various laboratory tests as ordered by the physician to diagnose a variety of medical problems.

4. **Medical Records:** All students must submit to the Health Center proof that they have had a physical exam and proof of immunizations.
5. **Pharmacy Services:** A registered pharmacist is available - Friday to dispense medication and provide patient teaching about all prescriptions filled.
6. **Health Education Services:** Prevention education is available through our health educator for a variety of health conditions. Someone is available Friday to assist with any health issues or concerns.

The center also undertakes to provide up-to-date and emerging information on health-related issues and concerns on a continuing basis for the University community.

## OFFICE OF INTERNATIONAL STUDENTS AND SCHOLARS

The Office of International Students and Scholars provides services and programs for international (foreign-born) students. The Office provides assistance with pre-arrival preparation, arrival/adjustment assistance, the admissions process, housing, insurance, and immigration matters. Orientation and advisement are provided to assist students with their adjustment to the University and community. In cooperation with various departments and organizations, including the International Student Association, the Office provides activities that enhance cultural, social, and personal development. (The Association is open to all international students with an interest in the goals of the organization.)

Students are encouraged to promote multicultural understanding by participating in a variety of activities in the Greensboro community.

Three hundred international students attend the University, and they represent 55 countries.

All international students are required to verify their immigration/residency status to the International Students and Scholars Office before registering at the University and notify the Office immediately of any change in their immigration status and address.

All F-1 non-immigrants are required to obtain an I-20 (Certificate of Eligibility for Non-immigrant Student Status for Academic and Language Students) from this institution prior to enrollment. (I-20's issued by another institution are not valid for attendance at A&T.) The requirements for an I-20 include a TOEFL score of 550 or above; a financial guarantee (letter of support, bank statement, and verification of salary from sponsor's employer); and a deposit for the first year's tuition and fees. Proof of valid immigration status is required if the applicant is currently residing in the United States. Academic transcripts must be evaluated by a credentials evaluation agency at the applicant's expense. For further information about admission requirements, contact the School of Graduate Studies Office at 336-334-7920.

Scholarships are not available through the International Students and Scholars Affairs Office. If you are interested in an assistantship or scholarship, you should contact your academic department.

Immigrants must provide the International Students and Scholars Office with a copy of their Permanent Resident Card. Foreign-born U.S. Citizens must provide a copy of their Certificate of Naturalized Citizenship. All other applicants should provide the documents necessary to verify current immigration status.

All non-immigrants are required to attend the International Student Orientation held during the registration period. The immigration law requires F-1 non-immigrants to complete their registration with the International Students and Scholars Office within 15 days after classes begin.

All non-immigrants are responsible for maintaining their legal immigration status. Non-immigrant students in F-1 visa status are required by United States Immigration regulations to



enroll full-time, except for the summer terms. Full-time enrollment is defined as enrollment every term in a minimum of 12 semester hours (undergraduate), or nine semester hours (graduate).

The legal regulations governing non-immigrant students are complex. The Director of the International Students and Scholars Office is available to explain these regulations in detail. F-1 non-immigrants are not eligible to work off-campus without approval from the U.S. Immigration and Naturalization Service and must maintain legal status in order to work on campus. F-2 and H-4 non-immigrants are not eligible to work.

Non-immigrant students are required to maintain comprehensive health and accident insurance coverage that includes repatriation and medical evacuation. Students must purchase insurance on a semester basis during registration. The policy must have specific levels of coverage to ensure that it is adequate to provide for medical costs in the U.S. Students are advised not to purchase insurance policies prior to arrival unless they cover the period from departure until enrollment in a new policy at the University. Government sponsored students and students with pre-existing medical conditions who have insurance should not cancel their insurance in order to purchase the University recommended plan. These students should consult with the Director of International Students and Scholars in regards to their coverage.

Any F or J non-immigrant who fails to provide proof of adequate insurance by the end of the regular registration period to the Director of International Students and Scholars will be billed for the University insurance. F and J visa holders are considered as non-residents and are assessed non-resident (out-of-state) fees.

The Office is located in Murphy Hall, Room 221, at the corner of Nocho Street and S. G. Thomas Drive. The telephone number is (336) 334-7551; the fax number is (336) 334-7001. Mrs. Sharon R. Martin is the Director of the International Students and Scholars Office and Adviser to the International Student Association. Her e-mail address is [martins@ncat.edu](mailto:martins@ncat.edu). The University's homepage address is <http://www.ncat.edu>.

## **GRADUATE PROGRAMS**

The School of Graduate Studies offers programs of study leading to the master's degree in 40 fields and the doctorate in three fields. Each student's program is planned with an advisory committee of graduate faculty members to provide the opportunity for gaining advanced knowledge in the particular field of study. Graduate education is the final stage in the development of intellectual independence. It is different from undergraduate education in that the student is encouraged to establish premises, to hypothesize, and to defend both the procedure and the conclusions of independent investigation. The burden of proof for the verifiability of knowledge rests on the student, not on the faculty member. Emphasis is placed upon the student's scholarly development through formal course work, seminars, research, and independent investigation.

Graduate students are expected to familiarize themselves with the requirements for the degrees for which they are candidates and are held responsible for the fulfillment of these requirements.

### **Master's Degrees**

The School of Graduate Studies offers programs of study leading to the Master of Science degree, the Master of Arts degree, and the Master of Social Work degree.

## Requirements for Master's Degrees

### Graduate Advisor and Graduate Advisory Committee

All students in master's programs must have a graduate advisor who is a member of the Graduate Faculty in the student's major department or program. The graduate advisor is appointed by the Coordinator of Graduate Programs. In addition, all students must have a graduate advisory committee. The advisory committee is composed of at least three members of the Graduate Faculty. The graduate advisor serves as chair or co-chair of the committee. The graduate advisory committee is appointed by the Coordinator of Graduate Programs in the student's department or program. At the time of the request for a permit to schedule the final oral examination, the Graduate School verifies that the committee is constituted properly.

### Plan of Graduate Work

The master's degree candidate must submit an approved Plan of Graduate Work to the School of Graduate Studies Office during the term in which the candidate will complete 15 or more credits toward the degree sought. If the 15 credits will be completed at the end of a regular semester, the Plan of Graduate Work must be submitted to the School of Graduate Studies Office five working days before registration for the following semester. If the 15 credits will be completed at the end of the summer session, the Plan of Graduate Work should be filed in the School of Graduate Studies Office within five working days following fall registration. The Plan of Graduate Work shows committee chairperson, other committee members, and a sequence of courses approved by the student's advisor. Each committee member's signature on the Plan of Graduate Work indicates approval for the Plan of Graduate Work. Upon approval by the School of Graduate Studies, the Plan becomes the student's official guide to completing his/her program. Any changes in the Plan of Graduate Work or exceptions to the schedule for submission of the Plan must be approved by the committee and the Dean of the School of Graduate Studies. Since there are many possible combinations of coursework, a specific Plan of Graduate Work is developed by the advisory committee with the student. The course work to be taken by the student and the thesis topic, where applicable, must be approved by the student's advisory committee and the Coordinator of Graduate Programs in the student's department or program. This should be done prior to completion of one-half of the credits on the plan.

### Declaration of Major

A graduate student shall declare and complete the requirements of one master's degree program before declaring another major. This does not prevent a student from changing a declaration of major.

### Time Limitation

The master's degree program must be completed within six successive calendar years. Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for out-dated work. Students enrolled in doctoral programs (Electrical, Industrial and Systems, and Mechanical Engineering) should see the appropriate section of the *Graduate Catalog* for details regarding the maximum time allowed to complete the degree programs. When the program of study is interrupted because the student has been drafted into the armed services, the time limit shall be extended for the length of time the student shall have



been on active duty, if the candidate resumes graduate work no later than one year following his/her release from military service.

## **Course Levels**

At the University, the department prefix, followed by a three-digit number, is used to designate all course offerings. The first digit indicates the classification level of the course. Courses numbered 600 through 699 are open to seniors and to graduate students. Courses numbered 700 and above are open only to graduate students. At least 50% the courses counted in the work towards a master's degree must be those open only to graduate students; that is, numbered 700 and above.

## **Credits**

A minimum of 30 semester credit hours is required for most master's degrees; however, some programs require more than 30. Also, many students, in order to gain the breadth desired in their program or to make up deficits in their undergraduate degree, will actually take more credit hours than the minimum required by the program. It is expected that a student can complete a program by studying full time for an academic year and one additional summer term, or by studying full-time during four nine-week summer sessions.

The minimum credit requirements for Master of Science in Engineering are 30 semester hours for students who elect to take the thesis option and 33 semester hours for students who take the non-thesis option.

## **Residence Requirements**

A minimum of three-fourths of the hours required for the master's degree must be earned in residence study at the University.

## **Transfer credit**

No more than six hours of the minimal 30-hour requirement will be accepted from other institutions. A graduate course which has been completed with a grade of "B" or better may be considered for transfer to a master's program provided that it has been completed in a graduate or post-baccalaureate classification at an accredited graduate school. Exceptions are allowed for transfer from foreign institutions if the department or program provides the Graduate School with adequate documentation that the course is relevant to the degree, with appropriate content and level of instruction resulting in student competencies at least comparable to those of students taking the equivalent course at North Carolina A&T State University, and that the course was taught by faculty who are qualified to teach at the master's degree level. Credit accepted by extension reduces the amount of credit that may be transferred from other institutions.

## **Transfer of Undergraduate Credit**

Graduate credit may be allowed for up to 6 hours of the minimal 30-hour requirement for courses taken at North Carolina A&T State University provided that it is at the 600 level or higher, that the grade is "B" or better, that it was not counted to fulfill undergraduate requirements, and that it is recommended by the student's undergraduate advisor prior to enrollment in the course. No graduate credit will be allowed for excess credits completed in an undergraduate classification at another institution.

## **Credits from Previous North Carolina A&T State University Master's Degree**

Only 12 credits from a previous North Carolina A&T State University master's degree may be counted toward the minimal 30-hour requirement.

## **Language Requirements**

A reading knowledge of one foreign language is required by some programs for the Master of Arts and the Master of Science degrees. Other departments may designate that the language requirement be filled from among those languages in which the Department of Foreign Languages conducts testing. Students should contact the major department for specific language requirements.

## **Thesis**

Theses prepared by candidates for the Master of Science and Master of Arts degrees, in programs requiring the thesis, must present an original investigation into a subject which has been approved by the student's advisory committee and the Coordinator of Graduate Programs in the student's major. Four copies of the thesis in final form as approved by the advisory committee, each signed by the members of the advisory committee, must be submitted to the School of Graduate Studies by a specific deadline in the semester or summer session in which the degree is to be conferred. Detailed information on the form and organization of the thesis is presented in the Graduate School's *Thesis and Dissertation Manual*, which is available in the School of Graduate Studies Office or on the website at [www.ncat.edu](http://www.ncat.edu).

## **Final Comprehensive Examination**

Students enrolled in a master's degree program or a doctoral degree program may be tested by a comprehensive examination to determine the student's knowledge and skills in a general subject matter area of concentration. The comprehensive examination date will be announced by the departmental graduate committee chairperson at the beginning of the semester. This examination will be administered to the enrolled student by an examining committee of the department. Eligibility to sit for the examination will be determined by the departmental graduate committee and the results of the examination will be forwarded to the School of Graduate Studies Office no later than 30 days prior to the end of the semester. Students may only take the comprehensive examination twice.

After a second failure, the student must petition the Coordinator of Graduate Programs and the Graduate Dean for approval to take the exam a third time. If the student is unsuccessful after the third attempt, the student is dismissed from the Graduate Program.

## **Comprehensive Final Oral Examinations**

Candidates for master's degrees must pass a comprehensive oral examination to demonstrate to the advisory committee that he/she possesses a reasonable mastery of the subject matter of the major and supporting fields and that this knowledge can be used with promptness and accuracy. This examination may not be held until all other requirements, except completion of the course work in current registration during the final semester, are satisfied. A request for a permit to schedule the examination may be filed with the Dean of the School of Graduate Studies after the above conditions are met. The School of Graduate Studies will check to determine that the advisory committee and the courses taken by the student meet Graduate School requirements. If all requirements are met, the permit to schedule the final examination will be forwarded to the Director of Graduate Programs within 20 days of receipt of the re-

quest. Upon receipt of the permit, the student may proceed to schedule the exam at a time that is convenient to all members of the advisory committee. In those programs that require the thesis, the thesis must be submitted in complete form, except for such revisions necessary as a result of the final exam, to all members of the advisory committee at least two weeks prior to the exam.

A unanimous vote of approval of the advisory committee is required for passing the oral examination. Approval of the examination may be conditional, however, upon completion of additional work to the satisfaction of the advisory committee. A formal reexamination will not be required in this case. Failure of a student to pass the oral examination terminates the student's graduate work at North Carolina A&T State University, unless the graduate advisory committee unanimously recommends a reexamination. Only one reexamination will be given. A form giving the date that the exam was conducted and the result of the examination signed by all members of the advisory committee is forwarded to the Dean of the Graduate School by the Coordinator of Graduate programs in the student's department or program. A student may appeal all committee actions by written application to the Dean of the Graduate School.

Oral examinations for master's degree candidates are open to the Graduate Faculty by right and to the University community by unanimous consent of the advisory committee and the student being examined. Discussions and decisions regarding the student's performance are private to the advisory committee.

## **Summary of Procedures for Master's Degrees**

### **ALL STUDENTS**

- Application materials and required fees must be received.
- Application materials must be reviewed by department or program.
- The department or program must forward its recommendation regarding applicant's admissibility to the Graduate Dean.
- The School of Graduate Studies must review the recommendation and the student is notified of the action taken on the request for admission.
- The student must report to the department or program, be assigned a graduate advisor, and develop a roster of courses and credits with the advisor.
- The student must comply with requests from School of Graduate Studies for updated copies of transcripts from previous colleges or universities.
- The student must sign a patent agreement and file with School of Graduate Studies.
- The student is subject to continuous registration policy until graduation.
- The student must pass a language examination, if required.
- The student must pass a written examination, if required.
- The student must submit a diploma order form by end of sixth week of the semester or summer session of anticipated graduation.
- A grade point average of at least 3.0 for the degree requirements as well as on overall graduate coursework at North Carolina A&T State University is required for graduation.

All degree requirements must be completed within six calendar years, beginning with the date the student commences courses carrying graduate credit applicable to the degree program, unless a more restrictive time limit has been established by the department/program or academic college/school.

## **Students In Non-Thesis Programs**

- A graduate advisory committee of three or more Graduate Faculty members must be appointed by the Coordinator of Graduate Programs.
- A Plan of Graduate Work must be prepared by the student, in consultation with and with the approval of his/her graduate advisory committee. This plan must be approved by the Coordinator of Graduate Programs prior to completion of one-half the credits on the plan.
- When all requirements except completion of the course work in the final semester are satisfied, Coordinator of Graduate Programs must request that the Graduate School issue permit to schedule the final oral examination.
- If Graduate School requirements are met, a permit to schedule the final examination will be issued by the Graduate School within 20 working days of receipt of the request.
- The final examination must be scheduled and conducted.
- The final examination report, including date and result of the examination, must be submitted to the Graduate School by the Coordinator of Graduate Programs. This report should be received by the Graduate School within five working days of the examination.
- The deadline date for unconditionally passing the final examination in order for the student to graduate in a given semester appears in the Academic Calendar in this catalog as well as other Graduate School calendars.

## **Students In Thesis Programs**

- A graduate advisory committee of three or more Graduate Faculty members must be appointed by the Coordinator of Graduate Programs.
- A Plan of Graduate Work must be prepared by the student, in consultation with and with the approval of his/her graduate advisory committee. This plan must be approved by the Coordinator of Graduate Programs prior to completion of one-half the credits on the plan.
- A copy of a preliminary draft of the thesis, if required, must be submitted to the chair of the student's advisory committee.
- When all requirements except completion of the course work in the final semester are satisfied and after the thesis is complete except for such revisions as may be necessary as a result of the exam, the Coordinator of Graduate Programs will request that the School of Graduate Studies issue a permit to schedule the final oral examination.
- If Graduate School requirements are met, a permit to schedule the final examination is issued by the School of Graduate Studies within 20 working days of receipt of the request.
- At least two weeks prior to the final oral examination, the chair of the student's advisory committee must submit the thesis, if required, to the other members of the advisory committee for review.
- The final examination must be scheduled and conducted.
- The final examination report, including date and result of the examination, must be submitted to the School of Graduate Studies by the Coordinator of Graduate Programs. The report should be received by the School of Graduate Studies within five working days of the examination.
- The student must submit four copies of the thesis, signed by each member of his/her advisory committee, to the School of Graduate Studies.



- The deadline date for submitting four copies of the thesis to the School of Graduate Studies in order for the student to graduate in a given semester or summer session appears in The Academic Calendar in this catalog as well as other School of Graduate Studies calendars.
- The defended thesis is reviewed by the School of Graduate Studies to insure that the format conforms with the specifications prescribed in the *Thesis and Dissertation Manual*.

### **Requirements for Doctor of Philosophy Degree**

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work at the highest levels without supervision. The degree is therefore not granted simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. The student must demonstrate this ability by writing a dissertation reporting the results of an original investigation and by passing a series of comprehensive examinations in the field of specialization.

### **Advisory Committee and Plan of Graduate Work**

An advisory committee of at least four Graduate Faculty members, one of whom will be designated as chair, will be appointed by the Dean of School of Graduate Studies upon the recommendation of the Chairperson of the department. The committee, which must include at least one representative of the minor field, will with the student, prepare a Plan of Graduate Work that must be approved by the department and the School of Graduate Studies. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan. Any subsequent changes in committee or subject or in the overall plan must be submitted for approval as with the original plan.

The program of study must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor.

### **Residence Requirement**

For the Doctor of Philosophy degree, the student is expected to be registered for graduate work at an accredited graduate school for at least six semesters beyond the baccalaureate degree.

The basic University residence requirements are defined below. However, the College of Engineering has the prerogative of establishing more restrictive requirements within the respective schools.

### **Language Requirements**

Other departments may designate that the language requirement be filled from among those languages in which the Department of Foreign Languages and Literatures conduct testing. Doctoral students should contact the major department for specific language requirements.

### **Preliminary Comprehensive Examinations**

After completing the language requirement but not earlier than the end of the second year of graduate study and not later than one semester (four months) before the final oral examina-



tion, each doctoral student is required to take the preliminary comprehensive examinations. The examinations consist of two parts: written examinations and an oral examination.

The written portion may be conducted in one of two ways. In the first, each member of the advisory committee prepares a set of questions for the student's response, and answers to each set are returned to the appropriate member for grading.

The examination questions involved may cover any phase of the course work taken by the student during graduate study or any subject logically related to an understanding of the subject matter in the major and minor areas of study. The questions are designed to measure the student's mastery of the subject matter and the adequacy of preparation for research. Failure to pass the written preliminary examination terminates the student's work at this institution, subject to departmental and/or school policies with respect to reexamination.

Upon satisfactory completion of the written portion of the preliminary examinations and after completion of all course work relevant to the examination, authorization for the preliminary oral examination is requested from the School of Graduate Studies. This examination is conducted by the student's advisory committee and a representative from the School of Graduate Studies and is open to all Graduate Faculty members. The oral examination is designed to test the student's ability to relate factual knowledge to specific circumstances, to use this knowledge with accuracy and promptness, and to demonstrate a comprehensive understanding of the field of specialization and related areas.

A unanimous vote of approval by the members of the advisory committee is required for the student to pass the preliminary oral examination. Approval may be conditional, however, on the successful completion of additional work in some particular field(s). All committee actions may be appealed by written application to the Graduate Dean.

Failure to pass the preliminary oral examination terminates the student's work at this institution unless the examining committee recommends a reexamination. No reexamination may be given until at least one full semester has elapsed, and only one reexamination is permitted.

## **Candidacy**

A doctoral student is admitted to candidacy upon passing the preliminary examinations without conditions or after fulfilling any conditions specified by the advisory committee.

## **Qualifying Examination**

This is a written examination that is required of all Ph.D. students and that is scheduled each semester. The qualifying examination must be passed prior to the end of the third semester. Provisional students cannot sit for the qualifying examination. They must first gain a status change to unconditional admission. Consult the departmental handbook for details.

## **Preliminary Examination**

The preliminary examination is given in the semester following completion of all required coursework. In this oral examination, the student is asked about graduate course work and subject matter related to the specialization. It is also a presentation and defense of the proposed dissertation topic. Consult the departmental handbook for details.

## **Admission to Candidacy**

Admission to candidacy is given once the student has completed and passed all parts of the preliminary examination. Consult the departmental handbook for details.

## **Final Oral Examination**

The final oral examination is scheduled after the dissertation is complete. It consists of the defense of the methodology used and the conclusion reached in the research. Consult the departmental handbook for details.

## **Dissertation Submission**

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must be a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

Upon passing the Ph.D. final oral examination, each Ph.D. student must have the dissertation approved by each member of the student's advisory committee. The defended dissertation must be submitted to the School of Graduate Studies by the deadline given in the academic calendar, and must conform to the School of Graduate Studies' Thesis and Dissertations Manual, a copy of which may be obtained from the School of Graduate Studies Office. Once final approval is granted, four copies of the document signed by all members of the student's advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

## **Residence Requirement and Doctor of Philosophy Time Limit**

Two residence credits must be earned. In addition, the doctoral student has a maximum of six calendar years from admission to attain candidacy and ten calendar years to complete all requirements. The dissertation must be completed in five years after admission to candidacy. Consult the departmental handbook for details.

## **Credit Completion Requirements**

A minimum of 24 course credits and 12 dissertation credits beyond the Master of Science are required. Consult the departmental handbook for details.

## **Interinstitutional Doctor of Philosophy Program**

North Carolina A&T State University, North Carolina State University, and the University of North Carolina at Charlotte all participate in an interinstitutional Ph.D. program. Students seeking admission to such a cooperative program must satisfy all admission and degree requirements at the university where the Ph.D. will be issued as well as those of the student's home institution. Details are available at each of the departments involved in the interinstitutional Ph.D. program.

## **Summary of Procedures for Doctor of Philosophy**

- Application materials and the required fee are received.
- Application materials are reviewed by the department or program.
- The department or program forwards its recommendation regarding applicant's admissibility to Graduate Dean
- The Graduate School reviews the recommendation and notifies the student of the action taken on the request for admission.

- The student arrives, reports to the department or program, is assigned a graduate advisor, and develops a roster of courses and credits with the advisor.
- The student complies with requests from the Graduate School for updated copies of transcripts from previous colleges or universities.
- The student is subject to the continuous registration policy until graduation.
- An advisory committee of at least four graduate faculty members appointed by the Graduate Dean upon the recommendation of the coordinator of graduate programs.
- The Graduate Dean appoints a Graduate School representative to student's committee.
- A dissertation subject is selected and an outline of the proposed research submitted to the student's advisory committee and the coordinator of graduate programs for review and approval. A Plan of Graduate Work is prepared by the student, in consultation with and with the approval of his/her graduate advisory committee and the coordinator of graduate programs, and forwarded to the Graduate School for approval as soon as feasible after completion of 12 hours of course work.
- Written examinations in the major and minor fields are scheduled no earlier than the end of the second year of graduate study and not later than one semester before the final oral examination.
- When all written examinations have been completed satisfactorily, the chair or the coordinator of graduate programs requests the scheduling of the preliminary oral examination at least two weeks prior to the suggested date.
- The report of the examination is sent to the Graduate School and if, the examination has been passed without conditions, the student is admitted to candidacy.
- A copy of the preliminary draft of the dissertation is submitted to the chair of the student's advisory committee for review.
- At least two weeks prior to the final oral examination, the chair of the student's advisory committee submits the dissertation to advisory committee members for review. A copy is submitted to the Graduate School representative at least one week prior to the exam.
- One semester or its equivalent after admission to candidacy or later, after the dissertation is complete except for such revisions as may be necessary as a result of the final examination, and at least two weeks prior to the suggested date, the student's advisory committee chair or the director of graduate programs requests the scheduling of the final oral examination. Upon approval of the request, the student and the examining committee, including the Graduate School representative, are notified of the time and place of the examination.
- Results of the final oral examination are forwarded to the Graduate School.
- Upon the student's passing the final oral examination, four copies of the dissertation signed by each member of the student's advisory committee and five copies of the abstract must be submitted to the Graduate School by a specific deadline in the semester or summer session in which the degree is to be conferred. One copy each of the University Microfilms Agreement, the Survey of Earned Doctorate, and the Graduate School Exit Survey forms must be completed and submitted with the dissertation.
- The defended dissertation is reviewed by the Graduate School to ensure that the format conforms with the specifications prescribed in the *Thesis and Dissertation Manual*.
- All course work scheduled in a graduate degree classification must be completed prior to graduation.
- A grade point average of at least 3.0 for the degree requirements as well as on overall graduate course work at North Carolina A&T State University is required for graduation.
- The doctoral residence requirement of 2 residence credits must be satisfied.
- All degree requirements must be completed within ten years from admission to the doctoral program.

## THE NORTH CAROLINA A&T STATE UNIVERSITY LIBRARY

### Ferdinand Douglass Bluford Library

The new University Library was occupied in June 1991. The facility retains the name of the old library — The Ferdinand Douglass Bluford Library, named for the third President of the institution. The four-level building contains 153,428 square feet and will house more than 600,000 volumes.

The current holdings include more than 483,017 bound volumes, 4,588 serial subscriptions, and, as a select depository in North Carolina for United States government documents, the library contains over 257,338 official government publications. Other holdings include a superior collection of videotapes, microfilms, and other audiovisuals. The library maintains special collections in Archives, Black Studies and Teacher Educational Materials.

Special services are provided through a formal and informal library use instructional program, document delivery, interlibrary loans, and public access photocopiers. During the academic year the library is open 106.5 hours each week as shown below. Variations in this schedule are posted at the front entrance of the library.

Monday Thursday

7:30 a.m.-2:00 a.m.

Friday

7:30 a.m.-8:00 p.m.

Saturday

10:00 a.m.-8:00 p.m.

Sunday

2:00 p.m.-12:00 Midnight

Late Night Study

Sunday until 12 Midnight

– Thursday until 3:00 a.m.

**(Remains Open 24 hours during exams)**

### Educational Support Centers

The University's educational support centers include the Center for Student Success, the Audiovisual Center, the Closed Circuit Television Facility, a 10-watt student-operated educational Radio Station, the Computer Center, the Reading Center, Language Laboratory, and the Center for Manpower Research and Training.



## OFFICE OF CONTINUING EDUCATION AND SUMMER SCHOOL

The **Office of Continuing Education Studies and Summer School** provides educational and training opportunities for the nontraditional learner who desires such for career change or advancement, for degree or certification requirements, or for intellectual and cultural stimulation. Activities conducted by this office include the *administration of Continuing Education, Summer School, Extended Day Program, International Programs, and Adapted Physical Education*.

The **Continuing Education Studies Program** provides the administrative structure and coordination of extension credit courses, conferences, workshops, and short courses. The staff works with faculty and community groups to develop learning activities to meet the educational needs of individuals or groups. Special emphasis is given to technical certification programs leading to certification in several computer related fields.

The **Extended Day Program** is the coordinating unit for departments that offer classes in the evening and on weekends for students who are employed or otherwise not available during the 8-to-5 day.

The **Summer School** consists of two 5-week sessions, one 10-week session, and a two-week intersession, with short courses and workshops interspersed through the two sessions. This program provides summer study to meet the needs of graduate and undergraduate degree-seeking students, teachers, and other professionals, or any other persons for whom summer study will be of benefit in the attainment of their educational goals. Persons who have not been accepted into the School of Graduate Studies, but wishing to take courses in the Summer School must complete an application and pay the application fee before registering for the course.

Additionally, the office also coordinates the **Adapted Physical Education Program**. This program provides training and technical assistance to physical educators, classroom teachers, and other teachers of handicapped children in every local education administrative unit in the State.

### Summer School

Students interested in attending Summer School must complete a separate application and have a current year FAFSA on file. Graduate students generally receive only the Federal Direct Student Loan, if there is remaining eligibility. All students must attend the first summer session, dual session or first and second sessions to be eligible for aid. A student must be enrolled at least half-time to receive loan assistance.

## MAJOR RESEARCH CENTERS AND INSTITUTES

### Center for Advanced Materials and Smart Structures

The Center is an educational and research resource for North Carolina and the nation in the field of advanced ceramic materials and their composites. It operates as a collaborative effort among academe, private industry and the government in developing basic and applied research programs focused on integrating research and education.

Basic research in advanced ceramics, advanced composites, electronic ceramic devices, sensors and smart structures, III-V nitrides, ohmic contacts, and devices drives the Center's activities.



## **Center of Aerospace Research**

The Center's primary mission is to conduct high-quality research in aeronautics and astronautics. It performs critical research to support the development of NASA's High Speed Civil Transport programs, and the improvement of the agency's Single and Two State to Orbit missions. Ongoing research efforts are designed to support NASA's exploration of space and long-term human presence in space, as well as its investigations into enhancing life on Earth.

The Center's core research themes are aerospace structures, controls, and guidance; computational fluid dynamics, propulsion, and human-machine engineering. Center researchers are actively developing capabilities in space station design and management, and microgravity materials research.

## **Center for Autonomous Control Engineering**

The Center conducts interdisciplinary research in programs for the application of: fuzzy logic-controlled power electronic building block systems in HVAC systems; nonlinear active control of dynamic systems; artificial potential field-based motion planning/navigation in two- and three-dimensional dynamic environments, and other relevant topics. Its areas of concentration are soft computing, multi-agent systems, general artificial intelligence, control theory, generic algorithms, and energy conservation and power electronics.

## **Center for Composite Materials Research**

Research with polymeric-based composite materials began at the University in 1976, and the Center was established in 1988. Its major facilities are as follows: the Computational Laboratory, the Mechanical Testing Laboratory, the Diagnostic Laboratory, and the Composite Processing and Fabrication Laboratory. Research activities include the following:

- processing and fabrication of simple to complex composite components
- use of textile fiber architectures in the fabrication of non-trivial lightweight composite components
- testing and characterization of composite materials
- analysis of composite structural components
- development of innovative processing techniques with textile fabrics.

## **Center for Electronics Manufacturing**

The Center's goal is to strengthen the manufacturing, service, and research arm of the electronics manufacturing industry in the areas of productivity, quality, and timeliness in delivering products and services. Specifically, the Center focuses on the following:

- the need to reduce time to service or market
- the need to access leading manufacturing technologies while reducing investments
- the need to focus on core competencies
- the need to improve inventory management and purchasing power.

## **Center for Energy Research and Technology**

The Center's mission is to enhance undergraduate and graduate education through energy-related research, and to transfer that new knowledge to regional and national industries. Its objective is to improve economic competitiveness while reducing the environmental impact that results from excessive energy consumption. The Center's research focuses on energy use and energy efficiency in buildings and industrial processes, as they relate to technological, economic, political, and environmental issues.

## **Center for Environmental Remediation and Pollution Prevention**

The Center's primary mission is to promote research in science and technology leading to new and improved remediation techniques, with the goal of addressing difficult environmental problems facing North Carolina and the nation. The Center is designed to develop environmentally safe processes and new pollution prevention techniques.

## **Institute for Human-Machine Studies**

The field of human-machine system engineering emphasizes how users interact with machines, how usable machines are to users, and the impact of machines on user performance. The Institute is a comprehensive multidisciplinary program of basic and applied scientific research and technology development, directed toward understanding the nature of human performance while interacting with complex, technology-driven systems. Its focuses are as follows: cognitive engineering and human-system interface sciences, aviation and transportation human factors, information and communication technology integration, and health care and manufacturing applications.

## **International Trade Center**

Stimulating economic development and international trade is the Center's primary mission. Its educational activities are largely directed toward teaching students, providing research and related materials to small businesses, and providing technical assistance and information to the agricultural business community. Program emphases include the following:

- developing educational programs to enable farmers and processors to produce a broader range of products
- enhancing understanding of the linkages among national economies, world markets, and agriculture
- conducting market-based research to understand factors that influence competitiveness
- developing programs in North Carolina's rural communities to enhance entrepreneurial skills, create jobs, and diversify their economies

## **Rockwell Solid State Electronics Laboratory**

The Laboratory provides a vertically integrated laboratory environment for performing materials and device research, primarily in the area of compound semiconductors.

## **Transportation Institute**

The Institute's mission is to coordinate and manage interdisciplinary research, training, and technology transfer activities involving faculty, staff, and students from various departments within the University. It functions as a national and regional center for research and training, and as an information clearinghouse. The Institute's activities include the following: soliciting extramural funding, coordinating faculty development and student enrichment programs, facilitating technology transfer, providing technical assistance and public service, and coordinating other transportation-related programs.

## **Waste Management Institute**

The Institute is an interdisciplinary program designed to enhance awareness and understanding of waste management problems in our society, and to enhance instruction, research, and outreach aimed at improving the quality of life and protecting the environment. The Institute's goals are to increase the number of professionals in environmental and waste manage-

ment, enhance interdisciplinary research, increase public awareness, and facilitate cooperative and exchange programs among students, faculty, government, and industry.

## **INFORMATION TECHNOLOGY SERVICES**

Information Technology at North Carolina Agricultural and Technical State University is available to faculty, staff, students, and the community for curricula development, administrative use, research assistance, and tutorial services. Services are provided by the Information Technology Division.

The Information Technology division is divided into seven areas: Administrative Information Systems, Academy for Teaching and Learning, Center for Distance Learning, Client Services, Networking and Telecommunications, Systems and Software, and Research Computing.

### **Directorate of Administrative Information Systems (DAIS)**

The Directorate of Administrative Information Systems (DAIS) is responsible for central administrative computing and related information management activities for the University. AIS develops, maintains, and/or provides technical support for the campus financial, human resources, and student records as well as appropriate computing for other administrative functions in academic and administrative units. Most software is written in COBOL and FOCUS. The hardware consists of two clustered DEC Alpha DS20 computers for production usage, one Xerox DocuPrint 65 printer, and several smaller printers. Both production computers utilize the Open VMS operating system.

### **Directorate of the Academy for Teaching and Learning (DATL)**

The Directorate of the Academy for Teaching and Learning (ATL) is responsible for promoting and coordinating the scholarship of teaching and learning through effective use of pedagogy, technology, and assessment/evaluation. ATL provides instructional consultation, classroom and laboratory observation, conduct action research, instructional technology usage such as distance learning, teleclassrooms, teleconferences, and videotaping of instruction.

### **Directorate of the Center for Distance Learning (DCDL)**

The Directorate of the Center for Distance Learning (CDL) is responsible for both traditional and non-traditional students in implementing courses and programs to meet their educational needs without extended stays on campus. Courses are offered at a distance through the eLearning and extension programs. Students and instructors can interact via classrooms, streamed videos, and on-site instruction. The CDL serves as a mechanism by which North Carolina Agricultural and Technical State University can achieve its goals to "develop innovative instructional programs that will meet the needs of a diverse student body and the expectations of various professions."

### **Directorate of Client Services (DCS)**

The Directorate of Client Services is responsible for determining standards for computer hardware, software, and related equipment. DCS ensures that such equipment is appropriate for the University's computing environment. Furthermore, Client Services provides assistance in information delivery, problem management, and technical troubleshooting for recommended hardware and supported software packages for the university and is responsible for managing and supporting institutional classroom and public access computing labs. Additionally, the Client Services Directorate consults with information technology professionals on

campus regarding setting up and administering local area networks in their respective departments. For additional information please visit the website: <http://www.ncat.edu/~cit/csv/>

### **Directorate of Networking and Telecommunications (DNT)**

The Directorate of Networking and Telecommunications supports the education and research goals of the University by promoting and providing effective and reliable data, video, and voice connectivity for students, faculty and staff. For additional information please visit the website: <http://nts.ncat.edu/>

### **Directorate of Systems and Software (DSS)**

The Systems and Software Directorate is responsible for the day-to-day management of the academic computers and software systems. This includes monitoring and ensuring that the equipment is fully functional and responds to a user's need.

### **Directorate of Research Computing (DRC)**

The Directorate of Research Computing supports a variety of services aimed at improving the quality of research through the application of technology. The services consist of providing installation, operation and maintenance of information systems labs, electronic collaboration, technical support for research projects and consulting services. For additional information please visit the website: <http://nts.ncat.edu/>

## FIELDS OF INSTRUCTION

This section identifies and gives pertinent information about all the fields of study that participate in graduate education at North Carolina A&T State University. There are a total of 40 different fields offering graduate degrees. In addition, there are nine fields that offer minors at the graduate level and eleven areas that support graduate education through offering graduate level courses or in some other capacity. Fields of instruction that offer graduate degrees are listed first. Information given for each field includes the faculty, requirements for admission to and completion of the degree program(s), student financial support, courses offered, and other relevant information. Following the degree offering fields is a listing of other fields of instruction which offer graduate minors or graduate courses, or support graduate education in some other way. To avoid duplication, basic Graduate School requirements for admission and completion of graduate degree programs are not duplicated for each field of instruction. Only those requirements that are unique to the field are given in the sections on the individual fields. The Graduate School offers major programs of study in the following fields.

Agricultural Economics	Biology
Agricultural Education	Chemistry
Animal Health Science	English
Applied Mathematics	Health and Physical Education
Applied Physics	History
Biology	Mathematics
Chemistry	Social Work (Joint with UNCG)
Curriculum and Instruction	
Elementary Education	
Instructional Technology	
Reading Education (K-12)	
Engineering	
Architectural	
Chemical	
Civil	
Computer Science	
Electrical	
Industrial and Systems	
Mechanical	
English and African-American Literature	
Food and Nutrition	
Human Development and Services	
Adult Education	
Counselor Education	
Human Resources (Agency Counseling)	
Human Resources (Business and Industry)	
Industrial Technology	
Management Information Systems	
Technology Education	
Transportation and Business Logistics	
Vocational Industrial Education	
Plant and Soil Science	
Professional Physics	



# MAJOR FIELDS OF STUDY AND COURSE DESCRIPTIONS

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## Agribusiness, Applied Economics and Agriscience Education

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Anthony K. Yeboah, Interim Chairperson  
(336) 334-7943  
[yeboaha@ncat.edu](mailto:yeboaha@ncat.edu)

The Department of Agribusiness, Applied Economics, and Agriscience Education offers programs of study leading to the Master of Science degrees in Agricultural Economics and Agricultural Education. The program in Agricultural Economics prepares students for careers in teaching, research, extension, agriculture-related business, and government service. The program in Agricultural Education emphasizes the professional improvement of teachers and professional workers in related areas with education responsibilities while concurrently preparing students for employment in administration, supervision, extension, teacher education, business, and research in agricultural education and related fields. Both programs also prepare students for further graduate studies to achieve a terminal degree.

### DEGREES OFFERED

Agricultural Education - Master of Science

Concentrations: Professional Licensure, Professional Service

Agricultural Economics - Master of Science

Concentrations: Agricultural Marketing and International Trade, and Rural Development Policy

### GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution, with a grade point average of 2.65 (on a 4.0 scale) and a basic preparation in Agricultural Education, Education, General Agriscience, Agricultural Economics, Economics, Agribusiness or Business Administration, with a preparation in Economics/Statistics, generally will provide an acceptable preparation. Applicants who do not meet the requirements will be considered on an individual basis. Applicants are encouraged to provide GRE scores; however, these scores are not required for admission or graduation. A GPA of 3.0 is required for graduation.

### PROGRAM REQUIREMENTS

#### *Agricultural Economics:*

The Master of Science in Agricultural Economics requires that the students complete one of two options:

#### **1. THESIS OPTION - 30 Hours:**

This option requires a minimum of 30 semester hours, including 12 semester hours of "core" courses in advanced economic theory, a course in statistics and research methods, 9 semester hours of courses in the selected program track/**concentrations**, 1 elective 3-hour course, and 6 semester hours of thesis culminating in scholarly research work. In addition, the successful completion and defense of the thesis and a comprehensive examination are required.

## 2. **NON-THESIS OPTION - 30 Hours:**

This option consists of a minimum of 30 semester hours, including 15 semester hours of “core” courses in advanced economic theory, a course in statistics, econometrics and research methods, 9 semester hours of courses in the selected program track, 1 elective 3-hour course, and 3 semester hours of a scientific project. This non-thesis option recognizes the changes within the agricultural economics discipline relative to the manner in which research is conducted and reported such that it becomes more applied, action-oriented and evaluative. The student may choose to complete an econometrics project or an issues-based project. In addition, the successful completion and defense of the project paper and a comprehensive examination are required.

The student pursuing the Master of Science degree in Agricultural Economics/Agribusiness is required to complete a common core of courses consisting of:

AGEC 705	Advanced Statistics	3 Semester Hours
AGEC 710	Advanced Microeconomics	3 Semester Hours
AGEC 720	Advanced Macroeconomics	3 Semester Hours
AGEC 725	Research Methods	3 Semester Hours
or		
AGED 703	Scientific Methods of Research	3 Semester Hours

In addition, areas of concentration as specified require the following courses:

### **Rural Development Policy**

<b>Core Courses</b>		<b>12 Semester Hours</b>
<b>Program Track/Concentration Courses</b>		<b>9 Semester Hours</b>
AGEC 708	Econometrics	3 Semester Hours
AGEC 730	Rural Development	3 Semester Hours
AGEC 732	Agricultural Policy	3 Semester Hours
AGEC 740	Production Economics	3 Semester Hours
AGEC 750	Social Organization of Agriculture	3 Semester Hours
<b>Elective</b>		<b>3 Semester Hours</b>
<b>Thesis</b>		<b>6 Semester Hours</b>
<b>Total hours in concentration</b>		<b>30 Semester Hours</b>

### **Agricultural Marketing and International Trade**

<b>Core Courses</b>		<b>12 Semester Hours</b>
<b>Program Track/Concentration Courses</b>		<b>9 Semester Hours</b>
AGEC 632	International Agricultural Trade Policy	3 Semester Hours
AGEC 634	International Agribusiness Marketing	3 Semester Hours
AGEC 734	Agricultural Marketing	3 Semester Hours
AGEC 735	Economic Development	3 Semester Hours
AGEC 736	Marketing Problems and Issues	3 Semester Hours
AGEC 738	Theory of International Trade	3 Semester Hours
AGEC 756	Agricultural Price Analysis	3 Semester Hours
<b>Elective</b>		<b>3 Semester Hours</b>
<b>Thesis</b>		<b>6 Semester Hours</b>
<b>Total hours in concentration</b>		<b>30 Semester Hours</b>

**Notes: 1. Students who select the non-thesis option must take three hours of AGEC 708 (Econometrics) and three hours of AGED 750 (Community Problems).**

**2. The student, in consultation with his or her advisor, will select three courses from the program track of interest.**

#### **Agricultural Education:**

Students seeking admission into agricultural education have a choice of two major study concentrations: Professional Licensure and Professional Service. The Professional Licensure track is designed for individuals who are currently teaching secondary agricultural education, holders of the "A" License for secondary agricultural education in the State of North Carolina, or those individuals whom are within 12 hours of the "A" License. Students enrolled in the Professional Licensure Concentration are immersed in a curriculum based upon advanced competencies as mandated by the North Carolina Department of Public Instruction and National Board for Professional Teaching Standards. Students enrolled in the Professional Licensure concentration have the option to pursue a thesis or non-thesis track. Upon completion of this concentration students are eligible for the "M" License in secondary agricultural education for the State of North Carolina.

Students choosing the Professional Service concentration have the opportunity to develop a plan of study, which will prepare them for careers in the broad areas of extension education, public relations, social capital development, curriculum design, adult education, program development and evaluation, agribusiness, as well as positions in agriscience research. The Professional Service Concentration consists of a thesis and non-thesis option.

Upon admittance into the graduate program in Agricultural Education students are assigned an advisor who will guide the student in the development of their graduate committee, plan of study, Product of Learning, and Educational Inquiry Project/Thesis. Completion of 37 semester hours of approved graduate level courses is required for both study concentrations. A well balanced, unified, and complete program study will be required. In addition, those students who do not write a thesis must develop an educational inquiry project under the supervision of their graduate committee. The advisory committee will determine its nature and content. For those students who select the thesis option, he/she must complete 31 hours of approved graduate level courses and 6 hours of thesis credit. In both options students must successfully pass a written comprehensive examination in Agricultural Education to complete the degree program.

The student pursuing the Master of Science of Agricultural Education is required to complete a common core of courses consisting of:

<b>Course</b>	<b>Description</b>	<b>Credit</b>
AGEC 705	Advanced Statistics	3
or		
CUIN 710	Educational Statistics	3
AGEC 725	Research Methods	3
or		
AGED 703	Scientific Methods in Research	3

## COURSES IN AGRICULTURAL EDUCATION

Course	Description	Credit
AGED 600	Youth Organization and Program Management	3
AGED 601	Adult Education in Vocational and Extension Education	3
AGED 607	Environmental Education	3
AGED 608	Agricultural Extension Organization and Methods	3
AGED 609	Community Analysis and Rural Life	3
AGED 611	Special Problems in Agricultural Education	1-6
AGED 612	Field Studies in Agricultural Education	1-6
AGED 700	Seminar in Agricultural Education and Extension	1
AGED 701	Professional Service Seminar	1
AGED 703	Scientific Methods in Research	3
AGED 704	History and Philosophy of Vocational Education	3
AGED 705	Advances in Agricultural Business and Science	3
AGED 708	Scientific Methods in Educational Research II	3
AGED 709	Study and Application of Technological Advances and Best Practices to Agriculture	3
AGED 710	Program Design, Management, and Evaluation	3
AGED 711	Advance Teaching and Assessment Methods	3
AGED 712	Government Policy Analysis and Agriculture and Problem Solving Techniques for Field Settings	3
AGED 750	Community Problems	3
AGED 751	Agricultural Education Across the Curriculum	3
AGED 752	Special Populations In Agricultural Education	3
AGED 753	Program Planning	3
AGED 754	History of Agricultural Education	3
AGED 795	Agricultural Industry Internship	4
AGED 796	Master's Non-thesis Project Seminar	1
AGED 797	Agricultural Education Program Management Plan Project	4
AGED 798	Seminar in Agricultural Education	1
AGED 799	Thesis Research	6

## COURSES IN AGRICULTURAL ECONOMICS AND RURAL DEVELOPMENT

Course	Description	Credit
AGEC 632	International Trade Policy	3
AGEC 634	Commodity Marketing Problems	3
AGEC 638	Special Problems in Agricultural Economics	3
AGEC 640	Agribusiness Management	3
AGEC 641	Special Problems in Agribusiness Management	3
AGEC 644	Statistical Methods in Agricultural Economics I	3
AGEC 646	Statistical Methods in Agricultural Economics II	3
AGEC 648	Appraisal and Finance of Agribusiness Firms	3
AGEC 650	Human Resource Development	3
AGEC 675	Computer Applications in Agriculture	3
AGEC 705	Statistical Methods in Agricultural Economics	3
AGEC 708	Econometrics	3



AGEC 710	Microeconomics	3
AGEC 720	Macroeconomics	3
AGEC 725	Research Methods in Agricultural Economics	3
AGEC 730	Rural Development	3
AGEC 732	Agricultural Policy	3
AGEC 734	Agricultural Marketing and Interregional Trade	3
AGEC 735	Economic Development	3
AGEC 736	Agricultural Marketing Problems and Issues	3
AGEC 738	Theory of International Trade	3
AGEC 740	Production Economics	3
AGEC 750	Social Organization of Agriculture	3
AGEC 756	Agricultural Price Analysis	3
AGEC 799	Thesis Research	6

## **COURSES WITH DESCRIPTION IN AGRIBUSINESS, APPLIED ECONOMICS AND AGRISCIENCE EDUCATION**

### **Advanced Undergraduate and Graduate**

#### **Agricultural Economics**

#### **AGEC-632. International Agricultural Trade Policy Credit 3 (3-0)**

This course includes a review of economic and welfare theory applications relative to trade of agricultural commodities. Topical issues include the analysis of linkages among commodity programs, fiscal and trade policies for the U.S. and other countries in an interdependent world, development of an understanding of international institutions and their role in formulating elements of strategic agricultural trade policy. Prerequisite: Consent of instructor.

#### **AGEC-634. International Agribusiness Marketing Credit 3 (3-0)**

This course will examine and analyze the series of problems, issues, policies, regulations and procedures relevant to the global marketing of agricultural and related commodities by agribusiness firms. Emphasis will be on combining firm-level agribusiness marketing concepts with international agribusiness marketing and export management practices; including the development of international agribusiness marketing plans and case studies from international agribusiness firms. Prerequisite: Consent of instructor.

#### **AGEC-640. Agribusiness Management Credit 3 (3-0)**

This course focuses on methods of research, plans, organization, and the application of management principles. Part of the student's time will be spent in consultation with agribusiness firms. Prerequisite: Consent of the instructor.

#### **AGEC-641. Special Problems in Agribusiness Management Credit 3 (3-0)**

This course relies heavily on case studies and simulation models to help make decisions and solve problems faced by agribusiness managers. Also, students will be exposed to quantitative techniques for analyzing and solving problems confronting the firm. Emphasis is placed on applying theoretical concepts to the real-world decision-making environment. Prerequisite: Ag. Econ 640 or consent of instructor.

#### **AGEC-648. Appraisal and Finance of Agribusiness Firms Credit 3 (3-0)**

This course evaluates principles of land valuation, appraisal and taxation. Special areas include the role of credit in a money economy, classification of credit, principles underlying the economic use of credit and the role of the government in the field of credit.



**AGEC-650. Human Resource Development****Credit 3 (3-0)**

This course focuses on the analysis of human resources in relation to changing agricultural production technology in rural areas. Prerequisite: Consent of instructor.

**AGEC-675. Computer Applications in Agricultural Economics****Credit 3 (3-0)**

This course is designed to provide students with the tools to utilize computers for agricultural decision-making. Emphasis will be placed on utilizing existing software packages for micro-computers and mainframe computers to make financial, economic and quantitative analysis of farm and agribusiness-related problems. Prerequisite(s): Ag. Econ. 330 or Econ. 330.

**Agricultural Education****AGED-600. Youth Organization and Program Management****Credit 3 (3-0)**

Principles, theories and practices involved in organizing, conducting, supervising, and managing youth organizations and programs. Emphasis will be on the analysis of youth organization and programs in vocational and extension education.

**AGED-601. Adult Education in Vocational and Extension Education****Credit 3 (3-0)**

A study of the principles and problems of organizing and conducting programs for adults. Emphasis is given to the principles of conducting organized instruction in agricultural education, extension, and related industries.

**AGED-607. Environmental Education****Credit 3 (3-0)**

Principles and practices of understanding the environment and the interrelated complexities of the environment. The course will include a study of agricultural occupations related to the environment and materials that need to be developed for use by high school teachers of agriculture and other professional workers.

**AGED-608. Agricultural Extension Organization and Methods****Credit 3 (3-0)**

Principles, objectives, organization, program development, and methods in cooperative extension.

**AGED-609. Community Analysis and Rural Life****Credit 3 (3-0)**

Educational processes, structure and function of rural society, and the role that diverse organizations, agencies, and institutions play in the education and adjustment of rural people to the demands of modern society.

**AGED-611. Special Problems in Agricultural Education and Extension****Credit 1-6 (1-6)**

Special work in problems dealing with Agricultural Education and Extension will be examined. Students should be at the graduate level or be working on their lateral or provisional license in agricultural education.

**AGED-612. Field Studies in Agricultural Education****Credit 1-6 (1-6)**

Field Studies involved in Agricultural and Extension Education.

**Graduate Students Only****Agricultural Economics****AGEC-705. Statistical Methods in Agricultural Economics****Credit 3 (3-0)**

Advanced topics on analysis of variance, regression, correlation, multistage sampling and probability are covered in depth. Prerequisite: Ag. Econ. 646.

**AGEC-708. Econometrics****Credit 3 (3-0)**

This course focuses on the application of econometric techniques to agricultural economic problems, theory and estimation of structural economic parameters. Prerequisite: Ag. Econ. 705.

**AGEC-710. Microeconomics****Credit 3 (3-0)**

Price theory and the theory of the firm are covered comprehensively. The decision-making units in our economy and their market relationship are also examined.

**AGEC-720. Macroeconomics****Credit 3 (3-0)**

A continuation of aggregate economics, with emphasis upon measurement, growth and fluctuation of national income is the focus of this course.

**AGEC-725. Research Methods in Agricultural Economics****Credit 3 (3-0)**

The philosophical bases for research methods used in agricultural economics are discussed. Alternative research methods are compared with respect to their dependence on the concepts of economic theory, mathematics and statistics. Alternative approaches to planning research projects are evaluated.

**AGEC-730. Rural Development****Credit 3 (3-0)**

This course focuses on the application of economic theory, alternative growth models, requirements for growth, and quantitative techniques to problems concerning rural economic development and growth with emphasis on agriculture.

**AGEC-732. Agricultural Policy****Credit 3 (3-0)**

Advanced analysis of the role of agriculture in the general economy and of economic, political and social forces which affect development of agricultural policy is the substantive focus of this course.

**AGEC-734. Agricultural Marketing and Interregional Trade****Credit 3 (3-0)**

This course is designed to apply basic economic theory to interpret the essential components of the domestic and international marketing process for agricultural products. The primary focus will be on the spatial, temporal and form dimensional of market price analysis with significant emphasis on regional interrelationship and specialization, current trade issues and the rationale for trade. Specifically, students enrolled in this course will receive intensive instruction in the complex organization and function of the world's food marketing system.

**AGEC-735. Economic Development****Credit 3 (3-0)**

This course is designed to analyze factors and issues involved in the process of economic growth and development, with emphasis on developing countries. The theories, problems, objectives and strategies of development, including major policy issues, resources, and constraints of alternative strategies are discussed. The role of capital, technology, agriculture and international trade in the development process are examined.

**AGEC-736. Agricultural Marketing Problems and Issues****Credit 3 (3-0)**

This course is designed to examine current complex problems in agricultural marketing and methods of developing solutions.

**AGEC-738. Theory of International Trade****Credit 3 (3-0)**

The principal aim of this course is to familiarize the student with the fundamental mechanisms and theory (pure and monetary) of international trade. Selected topics will include the law of comparative advantage, gains from trade, factor endowments and growth theories, commercial policy, foreign exchange and the balance of payments, and the monetary and portfolio balance mechanisms. Prerequisite: Consent of instructor.

**AGEC-740. Production Economics****Credit 3 (3-0)**

This course focuses specifically on production economics theory in a quantitative framework. Technical and economic factor-product, factor-factor, and product-product relationships in single and multi-product firms under conditions of perfect and imperfect competition in both factor and product markets are topical areas.

**AGEC-750. Social Organization of Agriculture****Credit 3 (3-0)**

This course is designed to analyze the status and role of agriculture in rural societies from a sociological perspective. Emphasis will be placed on understanding the organizational structure of agriculture and the intended and unintended consequences of rapid technological change on agriculture.

**AGEC-756. Agricultural Price Analysis****Credit 3 (3-0)**

The use of price information in the decision-making process is the essence of this course. The relation of supply and demand in determining agricultural prices and the relation of prices to grade, time, location, and stages of processing in the marketing system are considered. The course also includes advanced methods of price analysis, the concept of parity and the role of price support programs in agricultural decisions. Prerequisite: Consent of instructor.

**AGEC-799. Thesis****Credit 6 (6-0)****Agricultural Education****AGED-700. Seminar in Agricultural Education****Credit 1 (1-0)**

A review of current problems and practices in the field of agricultural education and extension.

**AGED 701. Professional Service Seminar****Credit 1 (1-0)**

This course will prepare students for the entire Master's Program. Students will establish goals and objectives for their Master's Program. Students will also be introduced to the Professional Portfolio that is required of all Master's Students on the completion of their program.

**AGED-703. Scientific Methods in Research****Credit 3 (3-0)**

Methods of procedures in investigation and experimentation in education, accompanied by critical examination of studies made in agricultural education and related fields. A research problem is developed under the supervision of the staff.

**AGED-704. Foundation and Philosophy of Agricultural Education****Credit 3 (3-0)**

This advanced course deals with the development, organization, and philosophical foundations of agricultural education from colonial times to the present. Emphasis is placed on the role of societal and scientific changes, the federal government, and philosophy and its role in life including the rise of education in America, legislation having an impact on agricultural education, education in agriculture, and current issues in agricultural education on the evolution of agricultural education. Students will be expected to develop and defend their philosophy of agricultural education based on the foundations and philosophy of Agricultural Education. In addition to the above, students will be expected to research educational topics, critique the current research and present a seminar on their research topic.

**AGED-705. Advances in Agricultural Business and Science****Credit 3 (3-0)**

Students will review and study the literature on innovations in agri-business/science practices, processes and product technologies. They will become knowledgeable and articulate about issues related to the role and contribution of science and research to agriculture over time, the

development and diffusion of best practices, the impact of specific technological breakthroughs and basic techniques for assessing the efficacy of these.

**AGED-708. Scientific Methods in Educational Research II** **Credit 3 (3-0)**

This course covers advanced techniques in qualitative and quantitative research methodology focusing on the formulation of substantive research questions, problems or issues. Students will learn to apply a variety of educational research procedures such as ethnographic methodologies, evaluation research and case studies, qualitative choice models, nonparametric and parametric statistical methods and quasi-experimental techniques for field research and general linear models. Students will conduct, under the direction of the instructor, a research educational based project on their present agricultural educational experiences. Prerequisite: AGED 703.

**AGED-709. Study and Application of Technological Advances and Best Practices to Agriculture** **Credit 3 (3-0)**

This course provides students with an opportunity to observe and study the application of technological advances and best practices in a variety of settings in agriculture. In addition, students will work to develop a repertoire of skills and techniques that will enable them to select and apply innovations to their own educational settings, particularly the infusion of technology into the curriculum. The program will draw on the expertise of industry specialists and researchers, field trips and labs will provide hands-on experience. Prerequisite: AGED 705.

**AGED-710. Program Design, Management, and Evaluation** **Credit 3 (3-0)**

The planning, management and development of agricultural educational programs including needs assessment, objectives, development and content and materials selection. Evaluation of instructional programs; formative for program improvement and summative for outcomes accountability. Prerequisite: AGED 700.

**AGED-711. Advance Teaching and Assessment Methods** **Credit 3 (3-0)**

This course focuses on advanced concepts and methods relevant for both formal and informal agricultural education presentations, effects that methods may have on individuals involved in the learning experience and demonstrations of proficiency in use of various advanced methodologies, technologies and concepts. Students will focus on human learning development, diversity issues, motivational strategies to plan, use and evaluate student learning. Students will research and present projects based on the course of study. Students will keep a reflective journal based on the infusion of learning methods used in their educational occupations. Prerequisites: AGED 700 (701 for Professional Service Majors), 704, 709, 710.

**AGED-712. Government Policy Analysis and Agriculture and Problem Solving Techniques for Field Settings** **Credit 2 (2-0)**

Students will become conversant with basic principles, procedures, and phases of public policy formulation, analysis and decision making. Students will use agricultural issues/problem and policy as case studies to trace the evolution of an issue/problem/felt need into legislation or policy. Students will also learn basic techniques for analyzing policy impacts. Prerequisite: AGED 703.

**AGED-750. Community Problems** **Credit 3 (3-0)**

A study of the common problems of the community that relate to agriculture and related areas and of solutions for these problems.

**AGED-751. Agricultural Education Across the Curriculum** **Credit 3 (3-0)**

This advance course will center on the application of curriculum development models, theories and processes in agricultural education. A large portion of the class will be devoted to the



integration of agricultural curriculum into other subject areas such as Math, Science, English and History and the integration of other subject matter areas into agricultural education. Student will evaluate curriculum products and learn to modify curriculum to meet the needs of all students as well as reinforce other curricular areas. Students will see how content matter can be reinforced as it is taught across all curricular areas. Students will be expected to present a project based on developing curricular plans and materials that address curriculum integration as related to agricultural education. Prerequisite(s): AGED 700 (701 for Professional Service Majors), 703, 704, 710.

**AGED-752. Special Populations in Agricultural Education** **Credit 3 (3-0)**

This advance course will focus on the diverse needs of students for learning to take place. Special emphasis will be placed on the instruction of agricultural education to populations of students within economic, gender, ethnic, cultural, political, physical differences. Students will discover and use educational theory to examine strategies and plans to overcome problems in their educational occupations. Students will research both legal requirements and expectations that effect what can be done with increase student learning. Students will be required to develop and present a diversity management plan for their program. Prerequisite(s): AGED 700, 703, 704, 753.

**AGED-753. Teaching and Assessment for Agricultural Professionals** **Credit 3 (3-0)**

This course focuses on concepts and methods relevant for both formal and informal education presentations, effects that methods may have on individuals involved in the learning experience and demonstrations of proficiency in use of various educational methodologies, technologies and concepts. Students will focus on human learning development, diversity issues, motivational strategies to plan, use and evaluate student learning. Students will research and present projects based on the course of study. Students will keep a reflective journal based on the infusion of learning methods used in their educational occupations. Prerequisite(s): AGED 701, 704, 709, 710.

**AGED-754. History of Agricultural Education and Extension** **Credit 3 (3-0)**

Historical development, social and philosophical foundations, and current status in relation to the total vocational education program. Special attention is given to agricultural education and extension as it developed in the United States.

**AGED-796. Master's Non-thesis Project Seminar** **Credit 1 (1-0)**

This seminar will focus on the needs of bringing agricultural education programs up to date with public requirements and the success of all students. Students will be required to do outside reading in current educational trends in agricultural education and critique them. Students will present two seminars in this course. One will focus on an issue in agricultural education and the second will be based on the students Agricultural Education Program Management Plan. Prerequisite: AGED 797.

**AGED-797. Agricultural Education Program Management Plan Project** **Credit 4 (4-0)**

Students in the Non-thesis option will be required to put a management plan together for their educational occupational program. The plan will include research on the needs and expectations of the educational program and the evidence that either shows compliance or plans to meet the programs needs. Students will work with their committee to establish the requirement of the plan and evidence which will be required to meet the plans expectations. Students will present their plan in AGED 796. Prerequisite(s): AGED 700, 703 and 710.

**AGED-798. Seminar in Agricultural Education****Credit 1 (1-0)**

This course is designed for students who are in their last semester of their Master's program. The course focuses on the needs and expectations of being a Master Teacher and a leader in agricultural education. Students will be expected to present their Master Teacher portfolio at the end of the course. Students will also present seminars based on topics related to the overall themes, competencies, standards of the Agricultural Education Master's Program. Prerequisite: Last semester of the Master's Program.

**AGED-799. MS Thesis Research****Credit 6 (6-0)**

Master of Science thesis research under the supervision of the thesis committee chairperson, leading to the completion of the Master's thesis. This course is only available to thesis option students.

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## Animal Sciences

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The Department of Animal Sciences offers a graduate program in Animal Health Science that emphasizes the effects of environmental factors upon animal growth and development, reproduction, and disease resistance. Courses are designed to provide a solid foundation of fundamental biological and biochemical principles within the disciplines of breeding and genetics, biotechnology, food safety, microbiology, nutrition, pathology, physiology, and toxicology.

### OBJECTIVES

To advance scholarship in Animal Sciences and related disciplines; to prepare and increase the number of professionals with graduate training for employment in animal sciences, animal agriculture, biomedical, biotechnology and related industries, and to prepare students to enter Ph.D. degree programs.

### DEGREE OFFERED

Animal Health Science – Master of Science

### GENERAL PROGRAM REQUIREMENTS

The general requirements for admission to the program are an undergraduate degree from an accredited four year college or university with a minimum grade point average of 2.6 (on a 4.0 scale), and a basic preparation in animal and or laboratory animal sciences, biological, physical or agricultural sciences, or related areas. Applicants who do not meet the requirements will be considered on an individual basis. Applicants are encouraged to provide GRE scores, although these scores are not required for admission or graduation. A minimum of 30 credit hours and a GPA of 3.0 is required for graduation. Further, the student must successfully pass a comprehensive examination.

### PROGRAM ORGANIZATION

*Core Courses. Core courses provide the student with an understanding of the relationships between the animal and its environment, within specific biological disciplines. Core courses constitute 14 credit hours. Each student in the program is required to take the core courses.*

Course	Title	Credit (Lec.-Lab.)
ANSC 701	Environmental Topics in Animal Health	3 (3-0)
ANSC 702	Seminar in Animal Health I	1 (1-0)
ANSC 703	Seminar in Animal Health II	1 (1-0)
ANSC 799	Thesis Research in Animal Health Sciences	6 (1-6)
NARS 607	Research Design and Analysis	3 (2-2)

*Elective I Courses: Students are required to complete any three of the Elective I courses with a minimum of 8 credit hours.*

ANSC 604	Administrative and Regulatory Policies Governing Animal Use	2 (2-0)
ANSC 637	Environmental Toxicology	3 (2-3)
ANSC 641	Disease Management of Livestock and Poultry	3 (3-0)
ANSC 665	Techniques in Biotechnology	3 (2-2)
ANSC 712	Nutrition and Disease	3 (3-0)
ANSC 723	Animal Physiology	3 (3-0)
ANSC 782	Cellular Pathobiology	3 (3-0)
LASC 653	Laboratory Animal Management and Clinical Techniques	4 (2-6)

*Elective II Courses. Elective II courses (at least 8 credit hours) should be selected from, but not limited to, a pool of courses offered within and outside the department.*

ANSC 611	Principles of Animal Nutrition	3 (3-0)
ANSC 614	Animal Breeding	3 (3-0)
ANSC 624	Physiology of Reproduction	3 (3-0)
ANSC 708	Special Problems in Animal Health	2 (2-0)
ANSC 771	Advanced Design of Experiments	3 (3-0)
LASC 660	Special Techniques in Specimen Preparation, Immunological Techniques, Electron Microscopy	
	Radioisotopes, Radiology or Histotechnology	3 (1-6)
BIOL 671	Principles of Immunology	3 (3-0)
CHEM 651	General Biochemistry	3 (3-0)

## COURSES WITH DESCRIPTION IN ANIMAL SCIENCES

### For Advanced Undergraduate and Graduate Students

#### **ANSC-604. Administrative and Regulatory Policies Governing Animal Use** **Credit 2 (2-0)**

Regulations that impact the use of animals for research, education and testing. Federal, state and local regulations and policies. Regulations, facilities, and practices involving the use of hazardous agents (biological, chemical, and physical) which affect the safety of humans and animals. Prerequisite: Permission of instructor.

#### **ANSC-611. Principles of Animal Nutrition** **Credit 3 (3-0)**

Fundamentals of modern animal nutrition. Nutrient metabolism and role in productive functions. Prerequisite: ANSC 212.

#### **ANSC-613. Livestock and Meat Evaluation** **Credit 2 (1-2)**

Selection and evaluation of desirable animals in both market and breeding classes. Identification and evaluation of wholesale and retail cuts of meat. Prerequisites: ANSC 312 and ANSC 313.

#### **ANSC-614. Animal Breeding** **Credit 3 (3-0)**

Application of genetic and breeding principles to livestock production and improvement. Phenotypic and genotypic effects of selection methods; mating systems. Prerequisites: ANSC 211 and ANSC 214.

#### **ANSC-615. Selection of Meat and Meat Products** **Credit 3 (2-2)**

Identification, grading and cutting of meats. Prerequisites: ANSC 321 or ANSC 316.



- ANSC-618. Seminar in Animal Science** **Credit 1 (1-0)**  
A review and discussion of selected topics and recent advances in the fields of animal and food sciences. Prerequisite: Senior standing.
- ANSC-619. Special Problems in Livestock Management** **Credit 3 (3-0)**  
In depth study of problems in feeding, breeding, and management in the production of beef cattle, sheep and swine. Prerequisite: Senior standing.
- ANSC-624. Physiology of Reproduction in Vertebrate Species** **Credit 3 (3-0)**  
Mechanisms of reproductive processes with special emphasis on their interaction with the disciplines of nutrition, immunology and biochemistry. Prerequisites: LASC 461 or ANSC 723 or permission of instructor.
- ANSC-629. Special Problems in Dairy Management** **Credit 3 (3-0)**  
Problems in dairy cattle production. Prerequisite: ANSC 321 or senior standing.
- ANSC-637. Environmental Toxicology** **Credit 3 (2-3)**  
Sources, distribution, and toxicity of chemicals which are hazardous to the environments of man and animals. Prerequisite: LASC 636 or permission of instructor.
- ANSC-641. Disease Management of Livestock and Poultry** **Credit 3 (3-0)**  
Prevention and control of diseases in livestock species and poultry; Micro- and macroenvironments that result in disease. Prerequisites: ANSC 451 or permission of instructor.
- ANSC-657. Poultry Anatomy and Physiology** **Credit 3 (2-2)**  
Structure and function of tissues, organs, and systems of the domestic fowl. Prerequisite: ANSC 451.
- ANSC-659. Special Problems in Poultry** **Credit 3 (3-0)**  
Assignment of work in a student's area of interest; project method in Poultry Science. Prerequisite: Three advanced courses in Poultry Science.
- ANSC-665. Techniques in Biotechnology** **Credit 3 (2-2)**  
Basic principles and laboratory experiences in biotechnology. Concepts of DNA structure, function, related applications in biotechnology. Isolating DNA and RNA; genomic DNA and plasmid DNA analysis, gel electrophoresis, Southern hybridizations, gene probes. Prerequisites: ANSC 214, CHEM 251, BIOL 466 or permission of instructor.
- LASC-653. Laboratory Animal Management and Clinical Techniques** **Credit 4 (2-6)**  
Principles, theories and current concepts of laboratory animal science. Government regulations, ethical consideration, animal facility management and animal health surveillance. Prerequisite: Permission of instructor.
- LASC-660. Special Techniques in Specimen Preparation, Immunological Techniques, Electron Microscopy, Radioisotopes, Radiology or Histotechnology** **Credit 3 (1-6)**  
Special expertise in either preparation of animal models for classroom, museum and special display, the theoretical and practical aspects of immunological techniques, electron and light microscopy, radiology, tissue culture or histochemistry. Prerequisite: Permission of instructor.
- BIOL-671. Principles of Immunology** **Credit 3 (3-0)**  
A study of mammalian immune responses; particularly in humans. Special emphasis will be placed on the physiology, genetics, and regulation of immune responses. Interrelationships between nonspecific and specific immune reactions, humoral and cell-mediated immunity, ef-

factor cells, and diseases are also stressed; along with research and diagnostic methodologies. Prerequisites: BIOL 221 and BIOL 466; CHEM 221 and CHEM 222.

### **CHEM-651. General Biochemistry**

**Credit 3 (3-0)**

A study of modern biochemistry. This course emphasizes chemical kinetics and energetics associated with biological reactions and includes a study of carbohydrates, lipids, proteins, vitamins, nucleic acids, hormones, photosynthesis, and respiration. Prerequisites: CHEM 431 and CHEM 442.

## **GRADUATE STUDENTS ONLY**

### **ANSC-701. Environmental Topics in Animal Health**

**Credit 3 (3-0)**

Influence of the environment upon the health status of animals within the disciplines of epidemiology, toxicology, pathobiology, reproductive physiology, nutrition, and microbiology.

### **ANSC-702. Seminar in Animal Health I**

**Credit 1 (1-0)**

Seminar includes faculty and guest lectures on the philosophy of research and utilization of the scientific method, preparation for research and general research methodology. Presentations will be given by students on special topics in the field of animal health.

### **ANSC-703. Seminar in Animal Health II**

**Credit 1 (1-0)**

Presentations will be given by students on their completed thesis research.

### **ANSC-708. Special Problems in Animal Health**

**Credit 2 (2-0)**

Independent investigations to strengthen the student's knowledge of the scientific methods. Investigations may be conducted within a variety of research areas congruent with the environmental focus of the Animal Health Science program.

### **ANSC-712. Nutrition and Disease**

**Credit 3 (3-0)**

The effect of altering the levels and ratios of nutrients upon the health of an animal and resultant biochemical or biological processes. The effects of disease upon altered nutrient supply. Prerequisite: ANSC 611 or permission of instructor.

### **ANSC-713. Advanced Livestock Production**

**Credit 3 (2-2)**

Review of research relating to various phases of livestock production; fitting the livestock enterprise into the whole farm system. Special attention to overall economic operation.

### **ANSC-723. Animal Physiology**

**Credit 3 (3-0)**

An in-depth study of function and interrelationships among nervous, muscular, circulatory, respiratory, digestive, urinary and reproductive systems of laboratory and farm animals. Prerequisite: Permission of instructor.

### **ANSC-771. Advanced Design of Experiments**

**Credit 3 (3-0)**

Research designs suitable for investigation of multifactor experiments will be presented. Designs used in the agricultural sciences will be evaluated and emphasis will be placed on general linear models. Prerequisite: NARS 607 or permission of instructor.

### **ANSC-782. Cellular Pathobiology**

**Credit 3 (3-0)**

Current concepts of the structure, function and pathobiology of the cell. Methodologies used to study the cell and its processes. Prerequisite: CHEM 651 or permission of instructor.

### **ANSC-799. Thesis Research in Animal Health Science**

**Credit Variable (1-6)**

Research is conducted in an area of interest to the student under the guidance of a graduate faculty advisor.

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## Architectural Engineering

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### OBJECTIVE

The objective of the graduate programs in Architectural Engineering is to provide advanced professional studies in the areas of Structural Analysis and Design, Facilities Engineering, or Environmental Systems Analysis and Design.

### DEPARTMENTAL ADMISSION POLICY

The Master of Science in Architectural Engineering program is open to students with a bachelor's degree in engineering, technology, architecture, or a closely related field from an institution of recognized standing. In order to pursue a graduate degree in Architectural Engineering, an applicant must first be admitted to the Graduate School. The initial step toward Graduate School admission is to complete the required application forms and submit them to the Graduate School office. In addition to the application forms, two copies of the student's undergraduate and/or graduate transcript(s) and three recommendation letters are required. The student should also include an essay that describes his/her area of interest and reasons for wanting to pursue a graduate degree.

Processing of applications cannot be guaranteed unless applications are received, with all supporting documents, in the Graduate School office at least fifteen days prior to the beginning of registration for a given semester. Foreign nationals are encouraged to apply early; a minimum of one semester in advance of the anticipated enrollment date is recommended.

The graduate program in Architectural Engineering leads to a Master of Science in Architectural Engineering. The Master's program has two paths that are dependent on the applicants undergraduate academic background and interests. The two paths of study are (1) the Thesis Path and (2) the Non-Thesis Path.

1. **THESIS PATH** - For applicants who are full time graduate students, who are admitted under "**UNCONDITIONAL ADMISSION**," who are pursuing the "Thesis Option," and who may be interested in pursuing a Ph.D.
2. **NON-THESIS** - For applicants who are admitted as Unconditional or Conditional graduate students, who are pursuing the "Project Option" or the "Course Option."

### ADMISSION STATUS

1. **UNCONDITIONAL ADMISSION** - An applicant may be given unconditional admission to the MSAE program if he/she possesses:
  - a. an ABET (Accreditation Board for Engineering and Technology) accredited, four or five year bachelors degree in Architectural Engineering with an overall GPA of 3.0 or better on a 4.0 scale.
  - b. an ABET (Accreditation Board for Engineering and Technology) accredited, four or five year bachelors degree in Engineering with an overall GPA of 3.0 or better on a 4.0

scale. All students with a non-B.S.A.E. degree will be required to take AREN 650 - Design, Operations & Maintenance of Buildings I. However, those students enrolled in the Thesis Option will not receive degree credit for AREN 650. However, the grade received in AREN 650 will affect the grade point average of all enrolled students. Students must have a sufficient background to complete the MSAE program. Each applicants background will be evaluated on a case-by-case basis.

**It should be noted that a student must maintain a minimum of GPA of 3.0 in their graduate program to be eligible to receive financial assistance.**

2. **CONDITIONAL ADMISSION** - Applicants with an overall GPA of 2.65 or better on a 4.0 scale (or equivalent) may be granted conditional admission if they do not qualify for unconditional admission. The applicant must possess a recognized undergraduate Baccalaureate degree in architecture, engineering, technology or a closely related field, and the applicant must not have background course deficiencies that exceed twelve (12) credit hours.

Other admission conditions and program requirements may be imposed on a case-by-case basis as approved by the Dean of Graduate Studies and/or the Departmental Graduate committee. All conditional students must satisfy all background deficiencies within two terms with an average GPA of 3.0 or better.

In order to be qualified to sit for the Professional Engineering exam, students with non-engineering degrees may elect to complete additional undergraduate engineering courses. **It should be noted that a minimum GPA of 3.0 is required to be eligible to receive financial assistance.**

**CHANGE OF STATUS** - Conditional admission status will be changed to unconditional when the student has satisfied the two conditions below:

- a. All required course deficiencies have been completed with a 3.0 GPA or above and
- b. A minimum of a 3.0 GPA is attained in all A&T courses taken for graduate credit at the end of the semester in which the 9 credit hours of graduate course work is completed.

Failure to move to unconditional admission when first eligible will result in the student being subject to probation policies.

Conditional admission status is the entry level graduate admission classification. Students are not eligible to register for 700-level courses until they have achieved this classification. They can register in 700 level courses as conditional graduate students, provided that the courses are approved by the students' academic advisor.

3. **POSTBACCALAUREATE (PBS)**

Students not seeking to be admitted to a graduate program at A&T may be allowed to take courses for self-improvement or for renewal of teaching certificate if said students meet standard School of Graduate Studies entrance requirements. If a student subsequently wishes to pursue a degree program, he/she must complete the full admission process. The School of Graduate Studies reserves the right to refuse to accept towards a degree program credits which the candidate earned while enrolled as a PBS student; in no circumstances may the student apply towards a degree program more than twelve semester hours earned as a PBS student

**THESE STUDENTS ARE ADMITTED TO THE GRADUATE SCHOOL, NOT TO THE DEPARTMENT OF ARCHITECTURAL ENGINEERING, AND ARE SUBJECT TO THE RULES AND REGULATIONS OF THE GRADUATE SCHOOL.**

If a student subsequently wishes to pursue a degree program in Architectural Engineering, he/she must reapply for admission to the graduate program in the department after com-



pleting a minimum of 12 credit hours of upper level courses with an average GPA of 3.0 or higher. The Graduate School and the department reserve the right to refuse to accept credits toward the MSAE degree program that the candidate earned while being enrolled as a special student; in no circumstances may the student apply towards a degree program more than six semester hours of graduate credits as a special student. **Special students are not eligible to receive financial assistance.**

**Change of Admission Status**

It is the student's responsibility to apply to the School of Graduate Studies for a change in admission status. Students who fail to have their status upgraded run the risk of not receiving graduate credit for any completed graduate courses. Such students also run the risk of academic probation and dismissal.

**SPECIAL ADMISSION REQUIREMENTS FOR FOREIGN STUDENTS WITH NON-ACCREDITED DEGREES**

In addition to the application material described previously, foreign nationals are required to provide the following:

- 1. All foreign applicants, except those from English-speaking countries, must provide proof of English language proficiency by obtaining a score of 550 or better on the test of English as a foreign language (TOEFL). While this test does not effect students' admission, failure to pass it may necessitate taking remedial English courses designed to improve the students' ability to communicate in the English language.
- 2. All foreign students should show financial certification for the required amount of money from the applicant's sponsor and the appropriate bank before an I-20 can be issued.
- 3. All foreign nationals currently residing in the USA are required to complete a transfer clearance form and send it to the Office of International and Minority Affairs, in addition to the financial certification form.
- 4. The general GRE Test must be taken.

Specific information regarding visa and immigration requirements can be obtained from the International and Minority Students Affairs Office, North Carolina A&T State University, Murphy Hall, Room 221, Greensboro, NC, 27411. All application forms can be obtained from the School of Graduate Studies, Room 122, Gibbs Hall, North Carolina A&T State University, Greensboro, NC, 27411.

**BACKGROUND COURSES REQUIRED FOR ADMISSION:**

This section describes the general background courses required for an applicant to obtain the unconditional admission status. If the applicant does not have the following general background courses in his/her undergraduate curriculum, then he/she must complete these courses before being accepted as an unconditional Architectural Engineering Graduate student.

MATHEMATICS	CREDITS (min. hours)
Calculus	3
BASIC SCIENCES	
Physics	3
ENGINEERING	
Statics and Strength of Materials	6
Engineering Econ. Analysis or Financial Analysis	2
Computer Programming or demonstrated proficiency	2

All courses listed are the minimum requirements for admission to the department. Additional undergraduate courses may be required depending on the student's area of specialization, elective courses taken, and background. Evaluation of these additional courses, if any, will be made on a case-by-case basis by the department's graduate committee and academic advisor.

## **PROGRAM DESCRIPTION AND GRADUATION CRITERIA:**

The Master of Science in Architectural Engineering requires that students complete one of the following program options.

### **1. THESIS OPTION - 30 Hours:**

This option requires 24 hours of course work and 6 hours of thesis, and is specifically designed for students who wish to investigate a problem in depth and produce original, publishable findings under the academic advisor's direction. Thesis Option students must take six hours of AREN 789-Thesis and have a minimum of 12 hours of the total 24 hour course requirement at the 700 level. An original research topic must be chosen in conjunction with the student's advisor, culminating in the preparation of a scholarly thesis. An oral thesis defense/examination is required. This option is intended for students with strong research interests who may desire to later pursue a Ph.D. degree.

### **2. PROJECT OPTION - 33 Hours:**

This option consists of thirty (30) semester hours of course work and three (3) hours of special project. This option is intended for students with substantial engineering experience, but who do not wish to do a full Master's thesis. Project Option students must take three hours of AREN-788 Graduate Projects and have a minimum of 12 hours of the total 30 hour course requirement at the 700 level. A written project and oral presentation (or defense) are both required.

### **3. COURSE OPTION - 36 Hours:**

This option consists of thirty-six (36) semester hours of course work. This option is intended for students who intend no further graduate study and want to better prepare themselves for a professional career in Engineering. All course work option students must have a minimum of 18 hours of the total 36 hour course requirement at the 700 level.

## **THESIS/PROJECT DEFINITIONS:**

- a) **PROJECT** - A project must show application of engineering principals or judgment to arrive at a solution to a clearly defined problem.
- b) **THESIS** - A thesis must be original work that is of sufficient weight, complexity, and quality that would be acceptable for publication in an appropriate nationally recognized journal or conference proceedings.

## **AREAS OF SPECIALIZATION:**

Two areas of specialization are offered at the Master's level in Architectural Engineering: (1) Structures and (2) Facilities Engineering.

The suggested programs of study in each of these areas of specialization are shown on the following pages.

# MASTER OF SCIENCE IN ARCHITECTURAL ENGINEERING

## Applicants with a B.S.A.E. Degree

Core Courses (24 credit hours)		Credits
AREN 715	Research Methods	3
AREN 750	Integrated Building Design I	3
AREN 752	Integrated Building Design II**	3
AREN 756	Facilities Engineering Management**	3
AREN 753	Facilities Planning and Project Engineering**	3
600/700	Mathematics (minimum)***	3
600/700	Approved Electives*	6
		<hr/> 24

Thesis Option (30 total credit hours required including the Thesis)		Credits
AREN 789	Thesis+	6
Thesis Option Total		<hr/> 30

Project Option (33 total credit hours required including the Project)		Credits
600/700	Approved Electives*	3
AREN 788	Project+	3
Project Option Total		<hr/> 33

All Course Option		Credits
600/700	Approved Electives*	9
		<hr/>

### Course Option (36 total credit hours required) TOTAL 36

\* All Elective courses must be approved by the student's advisory committee.

\*\* Substitutions of these courses is allowed upon the recommendation of thesis advisor and approval by the student's graduate committee.

\*\*\* Mathematics requirement may be fulfilled by a graduate level analytical course upon approval of the student's graduate committee or the departmental graduate committee.

+ The student's thesis or project must receive prior approval from the student's thesis advisor and the student's graduate committee.

# MASTER OF SCIENCE IN ARCHITECTURAL ENGINEERING

## Applicants with a Non-B.S.A.E. Degree

Core Courses (24 credit hours)		Credits
AREN 652	Design, Operations & Maintenance of Bldgs. II	3
AREN 715	Research Methods	3
AREN 750	Integrated Building Design I	3
AREN 752	Integrated Building Design II**	3
AREN 756	Facilities Engineering Management**	3
AREN 753	Facilities Planning and Project Engineering**	3
600/700	Mathematics (Elective)***	3
600/700	Approved Electives*	3
		<hr/> 24

Thesis Option (30 total credit hours required including the Thesis)		Credits
AREN 650	Design, Operations & Maintenance of Bldgs. I (3)++	
AREN 789	Thesis +	6
Thesis Option Total		<hr/> 30

++ This is a required prerequisite for Non-B.S.A.E. degree students that will not count towards the Thesis option requirements but will affect the student's grade point average.

Project Option (33 total credit hours required including the Project)		Credits
AREN 650	Design, Operations & Maintenance of Bldgs. I	3
600/700	Approved Electives*	3
AREN 788	Project+	3
Project Option Total		<hr/> 33

All Course Option		Credits
AREN 650	Design, Operations & Maintenance of Bldgs. I	3
600/700	Approved Electives*	9

Course Option (36 total credit hours required)	<b>TOTAL</b>	<hr/> 36
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**NOTE: A STUDENT MAY BE ALLOWED TO TAKE A COURSE OPTION. THIS PRIVILEGE WILL BE EVALUATED AND GRANTED ON A CASE BY CASE BASIS.**

\* All Elective courses must be approved by the student's advisory committee.

\*\* Substitutions of these courses is allowed upon the recommendation of thesis advisor and approval by the student's graduate committee.

\*\*\* Mathematics requirement may be fulfilled by a graduate level analytical course upon approval of the advisor.

+ The student's thesis or project must receive prior approval from the student's thesis advisor and the student's graduate committee.



## PROGRAM ELECTIVES

Any courses in Engineering, Business, Math, or Technology offered at the 600 level or above may be used for electives in the AE program upon consent of the academic advisor and graduate coordinator of the department. (If the graduate coordinator is your advisor, electives must also be approved by another member of the department graduate committee.) These include but are not limited to:

IEEN 625	Information Systems
IEEN 650	Operations Research II
IEEN 664	Safety Engineering
IEEN 678	Engineering Management
IEEN 716	Engineering Statistics
CM 603	Manpower Planning

- Courses in MATH Department (600 level) in Operations Research, Linear Programming, Statistics (A&T and UNCG).

- Courses in Business Management (600 level) including courses in Real Estate Management, Finance, Risk Management, Project Management (A&T and UNCG).

- Courses in Industrial Psychology (600 level) (A&T and UNCG).

AREN 630	Advanced Structural Analysis
AREN 632	Structural Systems
AREN 633	Foundations & Soils
AREN 639	Masonry Design
AREN 642	Lighting Applications I
AREN 645	Electric System for Buildings
AREN 654	Facilities Management
AREN 657	Food Services Facility Engineering
AREN 662	HVAC Systems Design
AREN 672	Energy Conservation in Buildings
AREN 675	Energy Management for Buildings
AREN 684	City Planning and Urban Design
AREN 726	Reinforced Concrete II
AREN 727	Steel Structures II
AREN 730	Matrix Analysis of Structures
AREN 733	Foundation Engineering
AREN 736	Advanced Reinforced Concrete
AREN 737	Advanced Structural Steel
AREN 739	Wind & Earthquake Design
AREN 742	Illumination Engineering
AREN 754	Facility Planning and Site Analysis
AREN 755	Computer-Aided Project Management
AREN 757	Food Service Facilities Engineering
AREN 762	HVAC Systems Analysis and Simulation
AREN 765	Advanced HVAC Systems Design
AREN 770	Energy Management Planning
AREN 772	Advanced Energy Conservation Systems
AREN 778	Energy Maintenance and Management
MEEN 626	Advanced Fluid Mechanics
MEEN 722	Statistical Thermodynamics
MEEN 731	Conduction Heat Transfer

MEEN 732	Convection Heat Transfer
MEEN 733	Radiation Heat Transfer
MEEN 737	Solar Thermal Energy Systems

### Typical Plan of Study *B.S.A.E. Degree Students*

#### First Year

Fall		Credit	Spring		Credit
AREN 750	Int. Bldg. Design I	3	AREN 752	Int. Bldg. Design II**	3
AREN 715	Research Methods	3	600/700	Approved Elective	3
600/700	Mathematics (minimum)	3	AREN 753	Facility P.&P. Engr.**	3

#### Second Year

Fall		Credit	Spring		Credit
AREN 756	Facility Engr.**	3			
600/700	Approved Elective	3			

#### THESIS OPTION (30 credit hours):

AREN 789	Thesis	3	AREN 789	Thesis	3
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#### PROJECT OPTION (33 credit hours):

600/700	Approved Elective*	3	600/700	Approved Elective	3
			AREN 788	Project	3

#### COURSE OPTION (36 credit hours):

600/700	Approved Elective	3	600/700	Approved Elective	3
600/700	Approved Elective	3	600/700	Approved Elective	3

\* All elective courses must be approved by the student's advisory committee.

\*\* Substitutions of these courses is allowed with recommendation of thesis advisor and approval by the student's graduate committee.

### Typical Plan of Study *Non-B.S.A.E. Degree Students*

#### First Year

Fall		Credit	Spring		Credit
AREN 750	D.O.M. of Bldgs. I	3++	AREN 652	O.M. of Bldgs. II	3
AREN 715	Research Methods	3	600/700	Approved Elective*	3
600/700	Mathematics (minimum)	3	AREN 753	Facility P.&P. Engr.**	3

#### Second Year

Fall		Credit	Spring		Credit
AREN 750	Int. Bldg. Design I	3	AREN 752	Int. Bldg. Design II**	3
AREN 756	Facility Engr.**	3			

THESIS OPTION (30 credit hours):

AREN 789	Thesis	3	AREN 789	Thesis	3
++ This is a required prerequisite for Non-B.S.A.E. degree students that will not count towards the Thesis option requirements but will affect the students grade point.					

PROJECT OPTION (33 credit hours):

600/700	Approved Elective*	3	AREN 788	Project	3
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COURSE OPTION (36 credit hours):

600/700	Approved Elective*	3	600/700	Approved Elective*	3
			600/700	Approved Elective*	3

\* All elective courses must be approved by the student's advisory committee.  
\*\* Substitutions of these courses is allowed with recommendation of thesis advisor and approval by the student's graduate committee.

COURSES WITH DESCRIPTION IN ARCHITECTURAL ENGINEERING

Advanced Undergraduate and Graduate

**AREN-615. (625). Computer-Aided Building Design** **Credit 3 (0-6)**

This course provides an introduction to the application of computer-aided drawing as an engineering tool. The student will learn how to use a micro computer to develop 2D presentation drawings. Prerequisite: MATH 132, GEEN 102 or MATH 240. Corequisite: MEEN 335, Junior standing or consent of the instructor.

**AREN-630. (602.) Advanced Structural Analysis** **Credit 3 (3-0)**

This course emphasizes the more complex concepts of structural analysis for determinate and indeterminate structural systems using both hand calculations and computer software. Prerequisite: AREN 325 and AREN 326 or consent of the instructor.

**AREN-632. (604). Structural Systems** **Credit 3 (3-0)**

This course will discuss building structural systems, their form and function. Preliminary design techniques will be presented and system evaluation techniques discussed. Issues such as loading types and magnitudes, form work, construction loads, and speed of construction will be addressed. Torsional analysis techniques and the concepts of flexible and rigid diaphragms will be presented. The portal and cantilever methods of approximate structural analysis will be presented. Computer-aided structural analysis and design will be introduced. Prerequisite: Senior standing and AREN 430 or consent of the instructor.

**AREN-633. (561). Foundations & Soil Structures** **Credit 3 (2-3)**

The student will study the origin and composition of soil structure. The course includes the flow of water through soils, capillary, and osmotic phenomena. Soil behavior under stress is studied along with compressibility and shear strength. The elements of the mechanics of soil masses are studied with application to problems of bearing capacity of foundations, earth pressure on retaining walls, and stability of slopes. Prerequisite: AREN 430 or consent of the instructor.

**AREN-635. (471). Steel Structures I** **Credit 3 (3-0)**

This course is a continuation of AREN 430 emphasizing the concepts of steel structural member behavior. The design of tension members, beam-columns, members in torsion, connections and base plates are presented. The design of composite members is introduced. Prerequisite: Senior standing and AREN 430 or consent of the instructor.

**AREN-636. (481). Reinforced Concrete I****Credit 3 (3-0)**

This course is a continuation of AREN 430 emphasizing the concepts of reinforced concrete theory. The design of doubly reinforced beams, continuous beams, and beam-column behavior of concrete columns is addressed. Such topics as beam deflections and reinforcing bar bond stresses, and development lengths are also presented. Prerequisite: AREN 430 and Senior standing or consent of the instructor.

**AREN-639. (605). Masonry Design****Credit 3 (3-0)**

Concepts of reinforced masonry design are addressed. The properties of masonry materials will be reviewed and the procedures for the design of typical masonry components will be presented. Prerequisite: Senior standing and AREN 430 or consent of the instructor.

**AREN-642. Lighting Applications I****Credit 3 (2-2)**

This course applies to the principles of lighting design to the engineering of lighting systems. The course develops methodology for solving problems in both interior and exterior lighting. Prerequisite: AREN 442 or consent of the instructor.

**AREN-645. Electrical Systems for Buildings II****Credit 3 (2-2)**

This course is a continuation of AREN 345. The course covers the design of safe and reliable electrical distribution systems for commercial and industrial buildings. The topics included are circuit protection, feeder and branch circuit design, and fault analysis. Prerequisite: AREN 442, AREN 445 or consent of the instructor.

**AREN-650. Design, Operations & Maintenance of Buildings I** **Credit 3 (3-0)**

This course covers the fundamental knowledge related to structural, mechanical, and space enclosing building systems. The efficient operation and cost-effective maintenance of these building systems are investigated and evaluated to determine their impact on the management of a facility. This course introduces the facility engineer to the construction process, the structural systems, building envelope, interior enclosures, HVAC systems, fluid distribution, and other environmental systems that affect the efficient operation of a facility. This course is not open to BSAE students. Prerequisite: Consent of instructor.

**AREN-652. Design, Operations & Maintenance of Buildings II** **Credit 3 (3-0)**

This course covers the fundamental knowledge related to lighting/electrical, people movement in a facility, energy utilization and control, environmental safety, and security. The efficient operation and cost-effective maintenance of these building systems are investigated and evaluated to determine their impact on the management of a facility. This course introduces the facility engineer to the construction process, the lighting and electrical systems, vertical transportation, energy management, building environmental safety, exterior building environment, fire protection, and building security. Prerequisite: AREN 650.

**AREN-654. (624). Facilities Management****Credit 3 (3-0)**

This course deals with long range and master planning for facilities including space forecasting, project management, and post occupancy evaluation. Prerequisite: Senior standing and AREN 430. Corequisites: AREN 585 or AREN 586 or consent of the instructor.

**AREN-657. Foodservice Facilities Engineering****Credit 3 (3-0)**

This course presents an overview of restaurant design including the layout of the kitchen and kitchen equipment, the dining room, and ancillary areas. The major design emphasis is on energy efficient design of the HVAC system and the lighting. Prerequisites: AREN 442, AREN 462, and Senior standing or consent of the instructor. Corequisites: AREN 642 or AREN 662 or consent of the instructor.



**AREN-662. (612.) HVAC Systems Design****Credit 3 (3-0)**

This course addresses the design methodology, sizing, and selection techniques of pumps, fans, heat-exchangers, air washers, cooling towers and terminal units. Duct and pipe design methods are covered. Primary and secondary hydronic systems are covered including system air-control techniques. Design projects are required. Prerequisite: Senior standing and AREN 462 or consent of the instructor.

**AREN-670. (610). Energy and the Environment****Credit 3 (3-0)**

The course includes readings and discussions about energy, its origins, supply, transportation, and use. The effect of fossil fuels on the environment and environmental protection regulations are discussed. Renewable energy and the impact of energy costs on economic growth are investigated. Prerequisite: Senior standing or consent of the instructor.

The energy use patterns in schools and hospitals are studied in terms of the relevant IES and ASHRAE standards. The course presents the various utility rate structures energy auditing techniques along with the effect of operation and maintenance on the building energy use. Various retrofit options and computerized Energy Management Systems are investigated culminating in design projects. Prerequisite: Senior standing, AREN 361, AREN 442, and AREN 445 or consent of the instructor.

**AREN-675. (573). Energy Management for Buildings****Credit 3 (3-0)**

This course involves the study of renewable and nonrenewable energy sources for buildings, energy estimating methods (manual and automated) optimizing building enveloped design, comparative energy requirements for various HVAC systems. The students utilize the solar energy F-chart method, design of efficient lighting and electrical systems to solve design problems. Topics include energy management and control systems (EMCS) waste heat recovery, energy audit procedures for existing buildings, life cycle cost and techniques. Prerequisite: Senior standing or consent of the instructor.

**AREN-682. (431). Architectural Design III****Credit 3 (0-6)**

This course presents a series of problems for study of space analysis, space organization, form and function. The student learns how to integrate the architectural and the structural components. The course introduces the student to computer-aided drafting and design. Prerequisites: AREN 483, MEEN 336, Senior standing, and Design Option approval. Corequisite: AREN 325.

**AREN-683. (620). Architectural Design IV****Credit 3 (0-6)**

This course presents an advanced series of problems for study of space analysis, space organization, form and function. The student applies the integration of design, construction methods, and methods of the organization of structural components to a design project. Prerequisite: AREN 682.

**AREN-684. (622). City Planning and Urban Design****Credit 3 (1-4)**

This course looks at the history of city planning and urban design, general problems of city planning, and urban design-architectural space composition. The student studies regional and urban planning while investigating the scale of the plan for region and city presentations. The student looks at the relationships between the location of residential areas, industry, business and commerce. The design of the neighborhood unit is implemented. Prerequisite: Juniors enrolled in the program of the Transportation Institute and Architectural Engineering majors of Senior standing. Open to practicing design professionals.

**AREN-685. (660). Selected Topics****Credit 3 (Max. Total 6)**

The course allows a student to select an engineering topic of interest to the student to investigate in depth. The topic will be selected by the student and the student will find a faculty advisor before the beginning of the semester. The topic must be pertinent to the program the student is enrolled in and approved by the faculty advisor. Prerequisite: Consent of the instructor.

**AREN-686. (666). Special Projects****Credit 3 (Max. Total 6)**

The student must select a project on a special engineering topic of interest to the student and a faculty member, who will act as an advisor. The project and scope of work must be agreed on by the student and the faculty advisor before the beginning of the semester. The project may be analytical and/or experimental and encourage independent thinking. The topic must be pertinent to the program the student is enrolled in and approved by the faculty advisor. Prerequisite: Consent of the instructor.

**AREN-687. Directed Readings****Credit 3 (Max. Total 6)**

The student will select reading materials on an engineering topic of interest to the students and a faculty member, who will act as the advisor. The student must develop goals and objects for the course and submit a reading list and a plan for meeting the goals and objectives to the faculty member for approval prior to enrolling in the course. The student will work independently to complete the plan and the faculty advisor will act as the student's advisor for the course. Prerequisite: Consent of the instructor.

*Graduate Students Only***AREN-702. (724). Value Analysis in the Design and Construction of Buildings****Credit 3 (3-0)**

The students will make use of simulation and mathematical modeling as design analysis tools to minimize building life cycle costs. Structural systems, heating and air conditioning systems, lighting and power, plumbing and fire protection systems are included as part of the analysis. Value engineering principals are presented as they apply to the design of buildings. Prerequisite: Graduate standing and consent of the instructor.

**AREN-713. (731). Graduate Seminar.****Credit 1 (1-0)**

The course introduces the student to the procedures and expectations associated with earning a graduate degree. Research techniques are discussed and research topics are presented by the second-year graduate students. Prerequisite: Graduate standing and consent of the instructor.

**AREN-715. Research Methods****Credit 3 (3-0)**

This course presents an overview of approaches to problem identification, data collection and analysis procedures for studying building systems and occupant responsiveness. Covered topics will include: defining the problem and developing a testable hypothesis, techniques for identifying and collecting relevant information, selecting an appropriate research methodology, sensor characteristics and considerations, data structuring and analysis techniques, and presentation of results. Application of the Scientific Method to experimental procedures, computer simulation, analytical techniques, field studies and survey/questionnaire development will be discussed. A basic presentation of statistical analysis techniques will also be covered. Prerequisite: Consent of instructor.

**AREN-726. (601). Reinforced Concrete II.****Credit 3 (3-0)**

This course is a continuation of AREN 636 emphasizing the more complex concepts of reinforced concrete theory and their application to design. The analysis and design of special con-

crete structures will be addressed. Prerequisite: Graduate standing and AREN 636 or consent of the instructor.

**AREN-727. (472). Structural Steel II**

**Credit 3 (3-0)**

The design of composite structures, built-up beams, portal frames, and gabled frames are presented. Also addressed are the concepts of limit and plastic design. Prerequisites: Graduate standing and AREN 635 or consent of the instructor.

**AREN-730. (606). Matrix Analysis of Structures**

**Credit 3 (3-0)**

This course reviews Matrix algebra; statically and kinematically indeterminate structures. The student is introduced to the flexibility and stiffness methods as it applies to beams, plane trusses and plane frames. Prerequisite: Graduate standing and AREN 630 or consent of the instructor.

**AREN-733. (603). Foundation Engineering**

**Credit 3 (3-0)**

This course will include subsoil investigations and design of foundations and other substructures. The student will study caisson design, cofferdam design, and methods of groundwater control construction. Prerequisite: Graduate standing and AREN 633 or consent of the instructor.

**AREN-736. (700). Advanced Reinforced Concrete**

**Credit 3 (3-0)**

This course is a continuation of AREN 726 emphasizing the design of reinforced concrete structures. The analysis and design of reinforced concrete structures will be addressed. Prerequisite: Graduate standing and AREN 726 or consent of the instructor.

**AREN-737. (706). Advanced Structural Steel**

**Credit 3 (3-0)**

This course is a continuation of AREN727 emphasizing the design of steel building structures. The analysis and design of steel structures will be addressed. Prerequisites: Graduate standing and AREN 727 or consent of the instructor.

**AREN-738. (759). Advanced Foundation Engineering**

**Credit 3 (3-0)**

This course is a continuation of AREN 633 emphasizing the design of foundations for building structures. The analysis and design of foundations will be addressed. Prerequisites: Graduate standing and AREN 633 or consent of the instructor.

**AREN-739. (703). Wind and Earthquake Design**

**Credit 3 (3-0)**

The course applies the principles of structural dynamics to determine the response of buildings to earthquake and wind induced forces. The response spectra is used to evaluate earthquake forces on the building. The behavior of wind and the variation in wind velocity are studied with respect to topography and the building height above ground. The course also investigates the response of building components to hurricanes and tornadoes. Prerequisites: Graduate standing and AREN 603.

**AREN-742. Illuminating Engineering**

**Credit 3 (3-0)**

The course develops numerical methods and methodology for solving special problems in lighting. Topics include advanced numerical methods and lighting design for exterior applications. The application and use of lighting energy codes and standards are applied to lighting design. Prerequisite: Graduate standing and AREN 642 or consent of the instructor.

**AREN-750. (623). Integrated Building Design I**

**Credit 3 (0-6)**

The course involves the interdisciplinary design of a building project of significant size and complexity. The course includes the design development and concept development of a major building for the architectural, structural, mechanical, and electrical systems. Computer programs are used to assist the students in program development, floor plan development, site



plan development, and cost estimating. Building codes are reviewed. **Prerequisite:** Graduate standing and consent of the instructor.

**AREN-752. (732). Integrated Building Design II** **Credit 3 (0-6)**

The course involves the interdisciplinary design of a building project of significant size and complexity. The course expands on the design developed in AREN 750. The student uses mathematical and computer-assisted techniques to design and analyze either the structural, mechanical, or electrical system for the building. The work is presented in Contract Document for utilizing computer aided design and drawing software. The interface problems encountered between architectural, structural, mechanical, and electrical systems are investigated and resolved. **Prerequisite:** Graduate standing and AREN 750 or consent of the instructor.

**AREN-753. Building Facilities Planning and Project Management** **Credit 3 (3-0)**

This course provides an in-depth study of the skills needed to manage a project from start to finish. Covered topics include: value planning, user needs, owning vs. leasing vs. developing, role playing, design development, design review, and implementation of plans. Project close-out, evaluation, and post-occupancy evaluation are also discussed, along with how to create a facility annual report. **Prerequisite:** Consent of instructor.

**AREN-754. (720). Facility Planning & Site Analysis.** **Credit 3 (3-0)**

The course includes strategic and long-range planning concepts, environmental impact studies, population and growth projections. Accessibility, storm water retention, and economics are also discussed. **Prerequisite:** Graduate standing and consent of the instructor.

**AREN-755. (721). Computer-Aided Project Management.** **Credit 3 (0-6)**

This course uses computer-aided analysis and design in project scheduling, manpower forecasting, cash flow analysis, progress reports, billings and profitability analysis. The emphasis is on the application of micro-computers in the management of a small consulting firm. **Prerequisite:** Graduate standing and consent of the instructor.

**AREN-757. Foodservices Facilities Engineering** **Credit 3 (3-0)**

This course presents an overview of commercial and institutional foodservice design including the layout of the kitchen and kitchen equipment, the dining room, and ancillary areas. The major design emphasis is on energy efficient design of the HVAC system and the lighting. **Prerequisite:** Graduate standing.

**AREN-762. (710). HVAC Systems Analysis & Simulation** **Credit 3 (3-0)**

The course deals with the analysis of HVAC computer programs used to predict energy-use. Hour-by-hour simulation programs are compared with bin weather data programs for accuracy and care of use. **Prerequisite:** Graduate standing and consent of the instructor.

**AREN-765. (784). Advanced HVAC System Design** **Credit 3 (3-0)**

This course deals with the HVAC design for complex facilities such as high rise office buildings, science laboratories, and/or hospitals. **Prerequisite:** Graduate standing and consent of the instructor.

**AREN-770. (712). Energy Management Planning** **Credit 3 (3-0)**

The course presents concepts of energy management planning for multi-building complexes such as universities, hospitals, and schools. Topics include data collection and analysis, facility audits, on-site metering, and the review of maintenance records and utility bills. **Prerequisite:** Graduate standing and consent of the instructor.



**AREN-772. (711). Advanced Energy Conservation Systems** **Credit 3 (3-0)**

The course includes advanced topics in energy conservation including thermal storage, district heating and cooling, waste heat recovery, and co-generation. Prerequisite: Graduate standing and consent of the instructor.

**AREN-778. (734). Energy & Maintenance Management** **Credit 3 (3-0)**

The course deals with computerized energy accounting methodologies and computerized maintenance management methodologies. The students will apply computer programs to an actual building in order to obtain real-world experience in program application. Prerequisite: Graduate standing and consent of the instructor.

**AREN-780. (723). Professional Practice and Labor Relations** **Credit 3 (3-0)**

The course deals with the legal aspects of engineering consulting and commercial construction. Topics include contracts, employment standards, collective bargaining, resolving labor disputes and the Occupational Safety & Health regulations. Prerequisite: Graduate standing and consent of the instructor.

**AREN-785. (789). Selected Topics** **Credit 3 (Max. Total 6)**

The course allows a student to select an engineering topic of interest to the student to investigate in depth. The topic will be selected by the student and a faculty advisor before the beginning of the semester. The topic must be pertinent to the program the student is enrolled in and approved by the faculty advisor. Prerequisite: Graduate standing and consent of the instructor.

**AREN-786. Special Projects** **Credit 3 (Max. Total 6)**

The student must select a project on a special engineering topic of interest to the student and a faculty member, who will act as an advisor. The project and scope of work must be agreed on by the student and the faculty advisor before the beginning of the semester. The project may be analytical and/or experimental and encourage independence. The topic must be pertinent to the program the student is enrolled in and approved by the faculty advisor. Prerequisite: Graduate standing and consent of the instructor.

**AREN-787. Directed Readings** **Credit 3 (Max. Total 6)**

The student will select reading materials on an engineering topic of interest to the students and a faculty member, who will act as the advisor. The student must develop goals and objects for the course and submit a reading list and a plan for meeting the goals and objectives to the faculty advisor for approval prior to enrolling in the course. The student will work independently to complete the plan and the faculty member will act as the student's advisor for the course. Prerequisite: Graduate standing and consent of the instructor.

**AREN-792. Architectural Engineering Masters Seminar** **Credit 1 (1-0)**

Discussions and reports of subjects in architectural engineering and allied fields will be presented. Prerequisites: None.

**AREN-793. Masters Supervised Teaching** **Credit 3 (3-0)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisites: None.

**AREN-794. Masters Supervised Research** **Credit 3 (3-0)**

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty. Prerequisites: None.

**AREN-796. (776,788). Masters Project****Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students. Permission of advisor required.

**AREN-797. (777,789). Masters Thesis****Credit 3 (3-0)**

Master of science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the master's thesis. This course is only available to thesis option students. Permission of advisor required.

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### OBJECTIVES

The Department's primary objective for the Master of Science degree program is to prepare students to enter doctoral programs and do research in academia, government or industry. In conjunction with that objective, this program will develop, through research experiences and other creative activities, independent thinking, creativity, critical judgment and personal integrity in the students participating in this program. With regard to specific skills, this program is designed to enhance the students ability to apply the scientific method in research, to design experiments, and to improve the student's proficiency in the verbal and written communication of research results in science. Finally, it is an objective of this program to enable its students to score at or above the 50 percentile on the GRE Subject Test in Biology after the first year in residency in the program.

The Department's primary objective for the Master of Science, Secondary Education with a concentration in biology degree program, is to prepare students who can effectively teach the fundamental concepts in biology to high school students. In conjunction with that objective this program is designed to produce students that can design and execute experimental research in biology. This program will also develop, through research experiences and other creative activities, independent thinking, creativity, critical judgment and personal integrity in the students participating in this program, particularly as they relate to the learning process in the classroom. The department will provide an environment for teaching professionals to undertake advanced studies of the diverse array of biological disciplines and gain a greater appreciation for the world of living things, our place among them, and the relationships between humans and the rest of the living environment. This program will also acquaint teaching professionals with the latest innovations and discoveries in biology.

### DEGREES OFFERED

- Biology - Master of Science (30 semester hours including 6 hours of thesis research. Half of all hours **must** be at or above the 700 level.)
- Biology - Master of Science, Secondary Education with concentration in Biology (39 semester hours of which 24 are to be in Biology and 15 are to be in Education. Half of all hours **must** be at or above the 700 level. There are two options in this degree program: thesis and non-thesis.)

### GENERAL PROGRAM REQUIREMENTS

The admission of students to both graduate degree programs in the Department of Biology is based upon the general admissions requirements of the University's School of Graduate Studies which are stated elsewhere in the Graduate Bulletin, as well as some specific Depart-

mental requirements that are chosen to assure the success of students admitted to the graduate programs in the Department. A student wishing to be accepted as a candidate to either of these two degree programs must have completed, on the undergraduate level, chemistry through organic II, one year of calculus, one year of physics (calculus-based physics is preferred) and courses in cellular and molecular biology. Some students lacking these requirements may be given provisional admission and required to successfully complete some or all of these courses before being admitted to candidacy. Applicants who submit transcripts from foreign institutions must provide credentials verified by a United States-based transcript verification service. Additional departmental requirements specific to the two degree programs are listed under the headings for those two programs below. Application deadlines for Fall and Spring semester admissions are July 15th and November 15th, respectively. **The student is advised to read the Graduate Bulletin very carefully for additional graduate school requirements for admission to candidacy for a degree as well as other departmental requirements.**

### **BIOLOGY - MASTER OF SCIENCE DEGREE PROGRAM**

In addition to the general program requirements listed above, students in this degree program must take 6 semester hours of thesis research (BIOL 862 and 863) under the supervision of a thesis advisor approved by the Graduate Studies Committee. Students in this program must also obtain credit for 2 semester hours of seminar (BIOL 701 and 702) and 5 credit hours of biochemistry (CHEM 651 and 652). In addition the student must:

1. Complete a minimum of 17 additional semester hours bringing the total to 30 semester hours. Courses for graduate credit in Biology may be selected from Biology courses at the 600 - 800 levels. It should be noted that half of all hours must be from courses at or above the 700 level.
2. Maintain a 3.0 grade point average.
3. Participate in the Departmental Seminar Series.
4. Submit GRE (General Test and Subject Test in Biology) scores to the Graduate School Office before admission to the final comprehensive examination can be granted.
5. File for and complete the Qualifying Essay. This is a requirement of the School of Graduate Studies.
6. Satisfactorily complete an examination in a foreign language.
7. Have at least one academic year of residence at A&T.
8. Pass a final comprehensive examination in Biology. To sit for this examination the student must have a grade point average of 3.00 or greater and must have completed, or be currently enrolled in, all required and/or elective courses. The comprehensive examination will be offered at least once per year at a time selected by the Department but no earlier than the third week in March.
9. Satisfactorily present and defend the thesis.

### **BIOLOGY - MASTER OF SCIENCE, SECONDARY EDUCATION WITH CONCENTRATION IN BIOLOGY DEGREE PROGRAM**

#### **Special Admission Requirements:**

In addition to the general program requirements listed above, applicants for the Master of Science, Secondary Education with a concentration in Biology program must:

Have course credit in the applicant's undergraduate program in 11 foundation courses: an ecology course, a genetics course, a cellular or molecular course (cell biology, microbiology,



molecular biology, biochemistry, *etc.*), an organismal course (mammalogy, plant systematics, invertebrate zoology, *etc.*), a physiology course, two semesters of organic chemistry (with laboratories), two semesters of calculus and two semesters of physics. Students lacking one or more of these foundation courses may be granted provisional admission with the stipulation that these courses will be taken during the graduate program of study.

Have two years of supervised instructional experience in a private or public school setting, laboratory instruction while enrolled in a graduate program, or as a lecturer in a community college or four-year college or university.

Hold or obtain a North Carolina "A" Teaching Certificate at the elementary, middle, or secondary level or its equivalent license from another state.

Submit official scores for the Graduate Record Examination General Test or Miller Analogies Test.

Have an undergraduate overall GPA of 2.8 or better on a 4.0 scale.

Submit a satisfactory essay providing a statement on the applicant's purpose for pursuing a master's degree.

Provide 3 letters of recommendation from professional educators.

The Master of Science, Secondary Education with concentration in biology program has two options. Both require 39 hours of graduate course work. The Thesis Option requires 3 semester hours of thesis research (BIOL 862) under the supervision of a thesis advisor approved by the Graduate Studies Committee. The Non-thesis (Special Project) Option requires the preparation of a product of a learning portfolio of materials (lectures, laboratories, demonstrations, *etc.*) (BIOL 642) developed from the area courses in biology and consistent with the State Department of Public Instruction's mandated curriculum. The learning portfolio of materials will be done under the supervision of a graduate advisor approved by the Graduate Studies Committee. In addition the student must:

1. Complete the 5 courses of the 15 hour Professional Core ( CUIN 711, CUIN 712, CUIN 713, CUIN 721, and CUIN 746).
2. Complete 8 or more courses for 24 hours in Biology that are approved by the graduate advisor.
3. Submit GRE Subject Test in Biology scores to the Graduate School before admission to the final comprehensive examination can be granted.
4. Maintain a 3.0 grade point average.
5. File for and complete the Qualifying Essay. This is a requirement of the School of Graduate Studies.
6. Have at least one academic year of residence at A&T.
7. Pass final comprehensive examinations in Biology. To sit for this examination the student must have a grade point average of 3.00 or greater and must have completed, or be currently enrolled in, all required and/or elective courses in Biology. The Biology comprehensive examination will be offered at least once per year at a time selected by the Department but no earlier than the third week in March.
8. In the Thesis Option, satisfactorily present and defend the thesis. In the Special Project Option, satisfactorily present and defend the product of the learning portfolio.

## LIST OF GRADUATE COURSES

Course	Title	Credits (lec-lab)
BIOL 610	Prokaryotic Biology	3 (3-0)
BIOL 620	Food Microbiology	4 (2-4)
BIOL 621	Soil Microbiology	4 (2-4)
BIOL 630	Molecular Genetics	3 (3-0)
BIOL 631	Endocrine Physiology	3 (3-0)
BIOL 642	Special Problems in Biology	3 (2-2)
BIOL 665	Evolution	3 (3-0)
BIOL 667	Animal Physiology	3 (3-0)
BIOL 671	Principles of Immunology	3 (3-0)

## GRADUATE COURSES

Course	Title	Credits (lec-lab)
BIOL 700	Environmental Science	3 (3-0)
BIOL 701	Biological Seminar	1 (0-2)
BIOL 702	Biological Seminar	1 (0-2)
BIOL 703	Experimental Methods in Biology	4 (2-4)
BIOL 704	Cell and Molecular Biology	3 (3-0)
BIOL 739	Radio-isotope Techniques and Radiotracer Methods	4 (2-4)
BIOL 740	Essentials of Plant Anatomy	3 (2-2)
BIOL 741	Applied Plant Ecology	3 (2-2)
BIOL 742	Physiology of Vascular Plants	3 (2-2)
BIOL 743	Developmental Plant Morphology	3 (2-2)
BIOL 744	Plant Nutrition	3 (2-2)
BIOL 749	Recent Advances in Cell Biology	3 (3-0)
BIOL 750	Microscopy Technique	3 (1-4)
BIOL 759	Experimental Developmental Biology	3 (1-4)
BIOL 765	Introductory Experimental Zoology	3 (2-2)
BIOL 780	Animal Physiological Ecology	3 (3-0)
BIOL 862	Biology Thesis I	3 (0-6)
BIOL 863	Biology Thesis II	3 (0-6)

## COURSES WITH DESCRIPTION IN BIOLOGY

### Advanced Undergraduate and Graduate

#### **BIOL-610. Prokaryotic Biology** **Credit 3 (3-0)**

A survey of the taxonomy, classification, ultrastructure, reproduction, physiology, and ecology of selected bacteria and bacteriophages. The laboratory will emphasize self instruction and independent study. Prerequisites: Biology 200 or 221; Biology 466.

#### **BIOL-620. Food Microbiology** **Credit 4 (2-4)**

A survey of selected topics in food microbiology. Approximately one-third of the course will cover the metabolic pathways, organisms and processes involved with food production from fermented dairy products, vegetables, fruits and meats. Food spoilage, preservation, infection, and intoxicification will also be discussed. The laboratory will introduce students to the microorganisms involved with food production and spoilage. Prerequisites: Biology 200 or 221.

**BIOL-621. Soil Microbiology****Credit 4 (2-4)**

An introduction to the role of soil microorganisms in soil fertility. The activity of nitrogen-fixing bacteria and those involved in the decomposition of organic waste materials will be emphasized. The laboratory will introduce students to the enumeration, distribution, and characterization of microorganisms important to soil microbiology. Prerequisites: Biology 200 or 221.

**BIOL-630. Molecular Genetics****Credit 3 (3-0)**

DNA and RNA structure, function and processing in prokaryotic and eukaryotic systems. Various aspects of recombinant DNA technology will be examined. Prerequisites: Biology 201 and 466.

**BIOL-631. Endocrine Physiology****Credit 3 (3-0)**

This course would provide a basic introduction to endocrine function and include recent advances in the field of endocrinology. Emphasis will be placed on general aspects of endocrine physiology, the organization of the endocrine system, mechanisms of hormone action, and control of endocrine secretion. Prerequisites: Biology 201 and 462.

**BIOL-642. Special Problems in Biology****Credit 3 (2-2)**

Research projects on specific problems in biology for advanced students. Prerequisites: Biology 462 or 466 and permission of instructor. Prerequisites: Biology 462 or 466 and permission of instructor.

**BIOL-661. Mammalian Biology****Credit 3 (3-0)**

Study of the evolutionary history, classification, adaptation and variation of representative mammals. Prerequisites: Biology 160 and 260.

**BIOL-665. Evolution****Credit 3 (3-0)**

This course will emphasize the genetics of populations and sources of genetic variation; causes of genetic change in populations including natural selection; speciation; and the evolutionary history of life on earth. Prerequisites: Biology 310 and 466.

**BIOL-667. Animal Physiology****Credit 3 (3-0)**

This course will provide students with an understanding of the current state of animal physiology at the level of the whole organism and its component organs and organ systems. Emphasis will be placed on function as it relates to survival of organisms in natural environments and on the regulation of homeostatic mechanisms. Topics would include metabolism, temperature regulation, reproductive mechanisms, circulation, gaseous exchange, nutrient processing, osmoregulation and ionic balance. Prerequisites: Biology 160 and 462.

**BIOL-671. Principles of Immunology****Credit 3 (3-0)**

A study of mammalian immune responses; particularly in humans. Special emphasis will be placed on the physiology, genetics, and regulation of immune responses. Interrelationships between nonspecific and specific immune reactions, humoral and cell-mediated immunity, effector cells, and diseases are also stressed; along with research and diagnostic methodologies. Prerequisites: Biology 221 and 466; Chemistry 221 and 222.

**BIOL-700. Environmental Biology****Credit 3 (3-0)**

The scientific study of man's living and non-living environment. The course emphasizes how our technologies and cultures impact the earth's ability to sustain both human civilization and the earth's biodiversity. Prerequisites: None.

**BIOL-701. Biological Seminar****Credit 1 (0-2)**

Faculty will present lectures on their research areas to acquaint students with research opportunities in the department. Prerequisites: None.

**BIOL-702. Biological Seminar****Credit 1 (0-2)**

Oral and written presentations by students on special topics and recent advances in the field of Biology. Strategies for writing a thesis will be discussed, and the preparation by students of a short proposal for thesis research will be encouraged. Prerequisites: None.

**BIOL-703. Experimental Methods in Biology****Credit 4 (2-4)**

An introduction to the scientific method, basic techniques, and equipment used in experimental research in Biology. The course will provide a foundation for enabling students to initiate and conduct independent research. Prerequisites: None.

**BIOL-704. Cell and Molecular Biology****Credit 3 (3-0)**

A course that integrates the most recent advances in molecular biology of structure and function in cells. Prerequisite: Biology 462.

**BIOL-739. Radio-isotope Techniques and Radiotracer Methods****Credit 4 (2-4)**

The techniques employed in the handling and measurement of radio-isotopes and their use as tracer agents in biological investigations.

**BIOL-740. Essentials of Plant Anatomy****Credit 3 (2-2)**

A study of the growth, development and organization of roots, stems, leaves, and reproductive organs of higher plants. Lectures, discussions, field trips, and the laboratories are employed in the presentation of this course.

**BIOL-741. Applied Plant Ecology****Credit 3 (2-2)**

A study of the relation's of plants of their environment with emphasis on climate and soil factors influencing their structure, behavior and distribution. Prerequisite: Biology 640, 740, or equivalent.

**BIOL-742. Physiology of Vascular Plants****Credit 3 (2-2)**

Selected topics on the physiology of higher plants. Relationships of light quality, intensity, and periodicity to plant growth and reproduction: photosynthesis and photoperiodism. Chemical control of growth and reproduction, and the general aspect of plant metabolism. Lectures, conferences, laboratory work and field studies of higher plant ecology.

**BIOL-743. Developmental Plant Morphology****Credit 3 (2-2)**

Growth and differentiation from a cellular viewpoint with emphasis on quantitative description and experimental study of development phenomena.

**BIOL-744. Plant Nutrition****Credit 3 (2-2)**

A study of the subcellular organization of plants, inorganic and organic metabolism and respiration.

**BIOL-749. Recent Advances in Cell Biology****Credit 3 (3-0)**

A course designed to present recent trends concerning functions of organized cellular and subcellular systems. Current research as it relates to the molecular and fine structure basis of cell function, replication, and differentiation will be discussed.

**BIOL-750. Microscopy Technique****Credit 3 (1-4)**

This course is designed to develop the skills required to prepare cells, tissue, and organs for microscopic observation and study. Lectures will emphasize central concepts in microscopy. Prerequisites: Biology 201 and 462. Biology 465 is recommended.



**BIOL-759. Experimental Developmental Biology** **Credit 3 (1-4)**

This course is designed to provide students with a better understanding and appreciation of experimentation and experimental results in the area of developmental biology. Laboratory projects are experimental studies aimed at encouraging the reading and understanding of research papers in the literature Prerequisite: Biology 561 or graduate standing.

**BIOL-765. Introductory Experimental Zoology** **Credit 3 (2-2)**

Studies of fertilization, breeding habits, regeneration, growth and differentiation of certain invertebrates and vertebrates from the experimental approach. Emphasis will be placed on laboratory procedures on the frog and the chick.

**BIOL-780. Animal Physiological Ecology** **Credit 3 (3-0)**

An introduction to the physiological adaptations of individuals that enable them to make the internal adjustments necessary to grow and reproduce in changing environments. This course will emphasize the physiological strategies for nutrient acquisition, gaseous exchange, water and ion balance, and thermal tolerance. Prerequisites: Biology 310 and 462.

**BIOL-862. Biology Thesis I** **Credit 3 (0-6)**

Master's level research in biology. Prerequisite: Consent of advisor.

**BIOL-863. Biology Thesis II** **Credit 3 (0-6)**

Master's level research in biology. Prerequisites: Biology 862 and consent of advisor.

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## Chemical Engineering

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### OBJECTIVE

The objective of the graduate program in Chemical Engineering is to provide advanced level study in chemical engineering. The program will serve as preparation for further advanced study at the doctoral level or for advanced chemical engineering practice in industry.

### DEGREE OFFERED

Master of Science in Chemical Engineering (MSChE)

### GENERAL AND DEPARTMENTAL ADMISSION REQUIREMENTS

All applicants to MSChE program must have earned a bachelor's degree from a four-year college. Students that meet this requirement may be admitted to the graduate school. Applicants are admitted without discrimination of race, color, creed, sex, religion or national origin. Applicants may be admitted to graduate studies unconditionally, provisionally, or as special students. Unconditional admission to the Master of Science in Engineering Program with Chemical Engineering option will be granted to graduates of ABET accredited chemical engineering programs who have attained a minimum of a 3.0 Grade Point Average on their overall undergraduate program of study. Provisional admission may be granted to persons with other qualifications. Applicants for provisional admission will be evaluated on a case-by-case basis.

A student admitted provisionally is required to meet with the CHEN Graduate Program Coordinator to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate transcript. All provisionally admitted students must earn a minimum of a 3.0 grade point average on the first nine graduate course credits they complete. In addition, a "B" grade point average must be earned on all non-credit undergraduate courses, if any, required as a condition of admission. In addition to these provisions, other conditions may be imposed on a case by case basis as approved by the Graduate School.

The Master of Science in Chemical Engineering program consists of three distinct options, a thesis option, a project option and a course work option. Requirements for each of the options are given below:

<u>Option</u>	<u>Semester Hours Required</u>
Thesis	24 Credits of Courses and 6 Credits of Thesis
Project	30 Credits of Courses and 3 Credits of MS Project
Course Work	33 Credits of Courses

All students pursuing any of the MSChE options must complete four (4) courses from the MSChE core courses. In addition, students must enroll in MSChE seminar each semester.

Seminar credits do not count toward graduation requirements. The four (4) core courses must be selected from the following list:

<u>Number</u>	<u>Course</u>	<u>Credit</u>
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)
CHEN 630	Transport Phenomena I	3 (3-0)
CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)

**Thesis Option:** All students enrolled in this program must take six credit hours of thesis and twenty four credit hours of courses. Of the twenty-four credit hours of courses, at least nine credit hours of courses must be at 700 level. Four courses (12 credit hours) from MSChE core courses list. With the approval of the thesis advisor, a student may take nine credit hours of graduate courses from outside the CHEN Department in the areas of Mathematics, Science and Engineering. Thesis option students must pass an oral, public defense of their work. The defense is evaluated by a committee of three faculty who are appointed by the thesis advisor and the CHEN Graduate Program Coordinator. The defense committee serves as a professional review of the quality of the student's work and, in conjunction with the academic advisor, assists the student in the research work required for the thesis. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

**Project Option:** This option requires 30 credits of course work and 3 credits of project work (CHEN 796). The advisor and student select a suitable project of mutual interest to both. No formal advisory committee is required for the option. The project option may interest those who wish to investigate a specific problem and write a technical report. Of the thirty credit hours of courses, at least twelve credit hours of courses must be at 700 level. Students must take four courses (12 credit hours) from the MSChE core courses. With the approval of the MSChE Graduate Program Coordinator and/or project advisor, a student may take nine credit hours of graduate courses from outside the CHEN Department. In lieu of a final comprehensive examination, project option students must pass a public, oral defense of their project. The defense is evaluated by a committee of three faculty who are appointed by the project advisor and the CHEN Graduate Program Coordinator. One of the committee members will be the student's advisor. The defense is evaluated by a committee of three faculty who are appointed by the project advisor and the CHEN Graduate Program Coordinator. One of the committee members will be the student's advisor. The defense committee serves as a professional review of the quality of the student's work and, in conjunction with the academic advisor, assists the student in the research work required for the thesis. An affirmative vote by a majority of the committee after the defense is necessary for the student to pass. No comprehensive course exam is required.

**Course Work Option:** This option requires 33 credits of course work approved by the advisor and MSChE program coordinator. Of the thirty-three credit hours of courses, at least fifteen credit hours of courses must be at 700 level and must take four courses (12 credit hours) from the MSChE core courses. With the approval of the MSChE Graduate Program Coordinator, a student may take nine credit hours of graduate courses from outside the CHEN De-

partment. No formal advisory committee is needed, but the student must select an advisor. Students wishing to receive advanced training without an interest in solving a publishable problem or in writing a technical report will be attracted to this option. Students in this option must pass a written comprehensive examination. The examination follows the general course material of the student and set by 3 or more examiners selected by the CHEN Graduate Program Coordinator, one shall be the advisor. The student must satisfy the majority of examiners to pass the comprehensive examination. The examination is given during the student's final semester.

### **Advanced Undergraduate/Graduate Courses**

Course	Title	Credits (Lec-Lab)
CHEN 600	Advanced Process Control	3 (3-0)
CHEN 605	Biochemical Engineering	3 (3-0)
CHEN 608	Bioseparations	3 (3-0)
CHEN 615	Fuels and Petrochemicals	3 (3-0)
CHEN 618	Air Pollution Control	3 (3-0)
CHEN 620	Advanced Chemical Engineering Analysis	3 (3-0)
CHEN 622	Pollution Prevention	3 (3-0)
CHEN 625	Basic Food Process Engineering	3 (3-0)
CHEN 630	Transport Phenomena	3 (3-0)
CHEN 635	Mixing Processes and Equipment Scale-up	3 (3-0)
CHEN 640	Computer Aided Process Design	3 (3-0)
CHEN 645	Environmental Remediation	3 (3-0)
CHEN 660	Selected Topics in Chemical Engineering	Var. 1-3
CHEN 666	Special Projects in Chemical Engineering	Var. 1-3
CHEN 710	Transport Phenomena II	3 (3-0)
CHEN 720	Advanced Chemical Reaction Engineering	3 (3-0)
CHEN 730	Advanced Biochemical Engineering	3 (3-0)
CHEN 740	Advanced Chemical Process Design	3 (3-0)
CHEN 750	Separation Processes	3 (3-0)
CHEN 760	Advanced Chemical Engineering Thermodynamics	3 (3-0)
CHEN 786	Special Chemical Engineering Project	3 (3-0)
CHEN 789	Special Topics	3 (3-0)
CHEN 792	Chemical Engineering Masters Seminar	1 (1-0)
CHEN 793	Masters Supervised Teaching	3 (3-0)
CHEN 794	Masters Supervised Research	3 (3-0)
CHEN 796	Masters Project	3 (3-0)
CHEN 797	Masters Thesis	3 (3-0)



# CHEMICAL ENGINEERING COURSES AND DESCRIPTIONS

## CHEMICAL ENGINEERING GRADUATE/ADVANCED UNDERGRADUATE COURSES

### **CHEN-600. Advanced Process Control**

**Credits 3**

The course covers advanced methods for controlling chemical processes: adaptive control, feed forward control, cascade control, multivariable control, multi-loop control, decoupling, and deadtime compensation. Emphasis is placed on computer design. (DEMAND)

### **CHEN-605. Biochemical Engineering**

**Credits 3**

The course covers basic phenomena involved in biological systems, biochemical reaction systems, microbiology, and biological processes. Application of engineering methods to the design and control of biological systems. Biochemical production of industrial chemicals. Biological waste treatment. Immobilized enzyme technology. (DEMAND)

### **CHEN-608. Bioseparations**

**Credits 3**

The course is an introduction to the separation and purification of biochemicals. Separation processes are characterized as primarily removal of insolubles, isolation of products, purification or polishing. Processes covered include filtration, centrifugation, cell disruption, extraction, absorption, elution chromatography, precipitation, ultrafiltration, electrophoresis and crystallization. Students are required to complete a design project on a bioseparation process. (DEMAND)

### **CHEN-615. Fuels and Petrochemicals**

**Credits 3**

Topics important to the production of fuels are covered. Topics include extraction and processing of fossil fuels, synfuels, and fuels from renewable resources. Topics also include distillation, refining, fermentation, catalytic reactions, and removal of undesirable by-products. The design of fuel processes include emphasis on economic and environmental impact. (DEMAND)

### **CHEN-618. Air Pollution Control**

**Credits 3**

The economic, social and health implications of air pollution and its control are covered. To understand the problems better, the sources, types and characteristics of man-made air pollutants will be discussed. The course will review some of the main regulations and engineering alternatives for achieving different levels of control. An air pollution control system will be designed. (Course is to be cross referenced with CIEN 618) (DEMAND)

### **CHEN-620. Advanced Chemical Engineering Analysis**

**Credits 3**

Solution of chemical engineering problems by advanced mathematical techniques. Solution of uncoupled and coupled momentum, heat and mass transfer problems. Solution of linearized dynamic equations representing staged operations by matrix analysis. Advanced design and optimization of chemical processes. (Fall)

### **CHEN-622. Pollution Prevention**

**Credits 3**

The concept of pollution prevention and its application through industrial ecology, risk assessment and life-cycle assessment methodologies are covered. Topics include pollution prevention at the macroscale (industrial sector), mesoscale (unit operations), and microscale (molecular interactions). A process involving membrane separation steps will be designed and analyzed. (DEMAND)

**CHEN-625. Basic Food Process Engineering****Credits 3**

This course covers basic food processing topics including food preparation operations. Topics included are slurry flow, processing operations, microbiology and health hazards, diseases and medicines, and their effects on humans. (Fall)

**CHEN-630. Transport Phenomena****Credits 3**

A unified approach to momentum, energy, and mass transfer with emphasis on the microscopic approach. Development of the differential transport balances. Applications in solving simple chemical process problems. (Fall)

**CHEN-635. Mixing Processes and Equipment Scale-up****Credits 3**

The courses covers practical design concepts of mixing and multi phase processing in agitated tanks. Strategies for increasing plant throughput, improving contacting and mixing and selecting equipment will be given. This course provides information on: 1) judging the level of difficulty of a mixing process; 2) using practical elements of laminar, transitional and turbulent mixing; 3) mixing times and 4) increasing throughput for all types of systems and power. The course treats jet mixing, gas sparged mixing and mechanical mixing. The course provides basic concepts on using pilot plant studies for process translation and scale-up. (Spring)

**CHEN-640. Computer-Aided Chemical Process Design****Credits 3**

The development and use of computer-aided models for process equipment design is stressed. Model results are compared with the ASPEN PLUS simulation package. Students study the Interrelationships between design and process variables using computer simulation. Optimization methods are applied to chemical process design. (DEMAND)

**CHEN-645. Environmental Remediation****Credits 3**

The course introduces students to traditional and developmental methods for removal and detoxification of hazardous wastes at contaminated sites and from industrial waste streams. Chemical, thermal, biological and physical methods of remediation are covered. The course deals with hazardous wastes in soils, groundwater, surface water, wastewater ponds and tanks. The emphasis is on destruction, removal and containment methods using mathematical models for contaminate fate and transport. Recent advances in emerging technologies are also discussed. Each student will complete an environmental remediation design project. (DEMAND)

**CHEN-660. Selected Topics in Chemical Engineering****Credits 3**

Topics covered include selected chemical engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. (DEMAND)

**CHEN-666. Special Projects in Chemical Engineering****Credits 3**

Study arranged on a special chemical engineering topic of interest to both student and faculty member, who will act as supervisor. Topics may be analytical and /or experimental and should encourage independent study. (Fall, Spring)

**CHEN-710. Transport Phenomena II****Credits 3**

This course is an advanced treatment of the mechanisms of momentum, heat and mass transport. Emphasis is on methods of solution of transport problems for coupled systems where two or more transport processes interact. Other topics include Non-Newtonian Flow, Boundary Layer Theory, and the Analysis and solution of transport problems of significance in chemical processes. (DEMAND)

**CHEN-720. Advanced Chemical Reaction Engineering** **Credits 3**

This course includes an advanced treatment of chemical reaction engineering including effect of non-ideal flow and fluid mixing on reactor design, as well as multi-phase reaction system and heterogeneous catalysis and catalytic kinetics. (Fall)

**CHEN-730. Advanced Biochemical Engineering** **Credits 3**

This course is the study of advanced topics in biochemical engineering and enzyme engineering, highlighting research trends. Modeling and optimization of biochemical systems are also covered, as well as the design and analysis of enzyme reactors and the use of enzymes in industrial, environmental and medical applications. (DEMAND)

**CHEN-740. Advanced Chemical Process Design** **Credits 3**

Topics in advanced conceptual process engineering such as process analysis, process synthesis and process optimization are covered. Specific topics include: flowsheeting, design variable selection, computational algorithm formulation, separation sequences, heat exchanger networks, recycle-purge processes, process design and simulation software development, including physical and thermodynamic properties packages. (DEMAND)

**CHEN-750. Separation Processes** **Credits 3**

Differential and equilibrium stage operations involving non-isothermal and multi-component systems are covered. Other topics covered include simultaneous mass transfer and chemical reaction and dispersion effects. Applications to operations such as absorption, extraction, chromatography, distillation, ion exchange, and membrane separation are also studied. (Spring)

**CHEN-760. Advanced Chemical Engineering Thermodynamics** **Credits 3**

This is an advanced course covering topics in molecular thermodynamics of fluid phase equilibria. Statistical thermodynamics and thermodynamics of nonequilibrium processes are introduced. (Spring)

**CHEN-786. Special Chemical Engineering Project** **Credits 3**

The course is intended for students who want to complete an analytical or experimental project of interest to the student and instructor. The course may be completed by Project Option students, but does not substitute for Masters project. (Fall, Spring)

**CHEN-789. Special Topics** **Credits 3**

A course design to allow the introduction of potential new courses on a trial basis or offering of special course topics on a once only basis. The course may be offered to individuals or groups of students. A definite topic and the title must be agreed upon by the advisor before the student registers for the course. (DEMAND)

**CHEN-792. Masters Seminar** **Credit 1**

This course provides a forum for the presentation and discussion of selected topics of interest to chemical engineers such as faculty research interests, communication, safety, job prospects and research results. (Fall, Spring)

**CHEN-793. Masters Supervised Teaching** **Credits 3**

Students will gain teaching experience under the mentorship of a faculty member who assists the student in planning for the teaching assignment, observes and provides feedback to the student during the teaching assignment, and evaluates the student upon completion of the assignment. (DEMAND)

**CHEN-794. Masters Supervised Research** **Credits 3**

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty. (DEMAND)

**CHEN-796. MS Chemical Engineering Project****Credits 3**

This is an independent, analytical or experimental project involving research or design in an area of interest to the instructor and the student. This course must be completed by, and only by, Master of Science in Chemical Engineering (MSChE) project option students. A written proposal must be submitted to outline the project. A written report and an oral defense are required. (Fall, Spring, Summer)

**CHEN-797. Masters Thesis****Credits 3**

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the masters thesis. The course is only available to thesis option students. (Fall, Spring, Summer)



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## Chemistry

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Etta Gravely, Interim Chairperson  
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The objectives of the Graduate Division in Chemistry are to provide the theoretical and experimental training experiences necessary for those students pursuing a Master of Science degree in Chemistry. The Department also offers special courses that may be used for teacher renewal certificates.

### DEGREES OFFERED

Chemistry - Master of Science  
Chemistry Education - Master of Arts

### GENERAL REQUIREMENTS

Admission to the Graduate School under one of the following options:

1. Unconditional admission
2. Provisional admission
3. Postbaccalaureate (PBS)

### DEPARTMENTAL REQUIREMENTS

Admission to both degree programs require:

1. Baccalaureate degree from an accredited undergraduate institution

Admission to the Master of Science in Chemistry requires:

2. An undergraduate major in chemistry that includes one year of physical chemistry and one year of differential and integral calculus.

Admission to the Master of Arts in Chemistry Education also requires the following:

1. Official scores of the GRE or MAT Test
2. NC Class A licensure in Education (secondary) or the equivalent from another state
3. A passing score on the indexed rating for admissions criteria
4. A satisfactory essay providing a statement of purpose for Master's degree study
5. Satisfactory recommendations from three professional educators

M.S. in Chemistry:

Must complete the following:

1. *Required Courses*  
Chemistry 711 — Structural Inorganic Chemistry  
Chemistry 722 — Advanced Organic Chemistry  
Chemistry 743 — Chemical Thermodynamics  
Chemistry 701 — Seminar  
Chemistry 732 — Advanced Analytical Chemistry  
Chemistry 799 — Thesis Research

Chemistry 702 — Chemical Research  
(A maximum of 9 hrs. may be earned in 702)

2. *Other Requirements*

- a. 2-9 s.h. in electives
- b. Satisfactory completion of an examination in foreign language or computer language.
- c. Satisfactory presentation and defense of a thesis.
- d. One academic year of residence at A&T

M.A. in Chemistry Education: Thirty nine (39) semester hours required.

The Master of Arts in Chemistry program consists of a thesis option or a special project option. Both options require 15 semester hours of Professional Education, 17 semester hours of chemistry and 7 semester hours of chemistry electives. Elective courses may come from chemistry courses at the 600 and 700 levels. In addition the student must:

1. Maintain a 3.0 grade point average
2. Present a seminar to faculty and students of the Chemistry Department upon completion of the thesis or research project
3. In the thesis option, satisfactorily present and defend the thesis

M.A. in Chemistry:

Must complete the following:

Professional Education Core Requirements

Course	Description	Credit
CUIN 711	Research	3
CUIN 713	Learning Theories	3
CUIN 746	Technology	3
CUIN 712	Diversity	3
CUIN 721	Advanced Methods	3

Required Chemistry Courses  
17 hours

COURSE	TITLES	
CHEM 711	Structural Inorganic Chemistry	3
CHEM 722	Advanced Organic Chemistry	3
CHEM 732	Advanced Analytical Chemistry	3
CHEM 743	Chemical Thermodynamics	3
CHEM 702	Chemical Research	4
CHEM 701	Seminar	1

**COURSES FOR ADVANCED UNDERGRADUATES  
AND GRADUATES**

Course	Description	Credit
CHEM 610	Inorganic Synthesis	2
CHEM 611	Advanced Inorganic	3
CHEM 621	Intermediate Organic Chemistry	3
CHEM 624	Qualitative Organic Chemistry	3

CHEM 631	Electroanalytical Chemistry	3
CHEM 641	Radiochemistry	3
CHEM 642	Radioisotope Techniques and Application	2
CHEM 643	Introduction to Quantum Mechanics	4
CHEM 651	General Biochemistry	3
CHEM 652	General Biochemistry Lab	2

## GRADUATE STUDENTS ONLY

### *(Inorganic)*

CHEM 711	Structural Inorganic Chemistry	3
CHEM 716	Selected Topics in Inorganic Chemistry	3

### *(Organic)*

CHEM 721	Elements of Organic Chemistry	3
CHEM 722	Advanced Organic Chemistry	3
CHEM 723	Organic Chemistry	2
CHEM 726	Selected Topics in Organic Chemistry	3
CHEM 727	Organic Preparations	1-2

### *(Biochemistry)*

CHEM 756	Selected Topics in Biochemistry	3
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### *(Analytical Chemistry)*

CHEM 731	Modern Analytical Chemistry	3
CHEM 732	Advanced Analytical Chemistry	3
CHEM 736	Selected Topics in Analytical Chemistry	3

### *(Physical Chemistry)*

CHEM 741	Principles of Physical Chemistry I	3
CHEM 742	Principles of Physical Chemistry II	3
CHEM 743	Chemical Thermodynamics	3
CHEM 744	Chemical Spectroscopy	3
CHEM 746	Selected Topics in Physical Chemistry	3
CHEM 748	Colloid Chemistry	2
CHEM 749	Chemical Kinetics	2

## RESEARCH AND SPECIAL TOPICS

CHEM 701	Seminar	1
CHEM 702	Chemical Research	2-5
CHEM 715	Special Problems in Inorganic Chemistry	1
CHEM 725	Special Problems in Organic Chemistry	1
CHEM 735	Special Problems in Analytical Chemistry	1
CHEM 745	Special Problems in Physical Chemistry	1
CHEM 755	Special Problems in Biochemistry	1

## CHEMICAL INSTRUCTION

CHEM 663	Selected Topics in Chemistry INSTRUCTION I	1
CHEM 664	Selected Topics in Chemistry INSTRUCTION II	1
CHEM 765	Special Problems in Chemistry INSTRUCTION I	3
CHEM 766	Special Problems in Chemistry INSTRUCTION II	3
CHEM 767	Special Problems in Chemistry INSTRUCTION III	3
CHEM 768	Special Problems in Chemistry IV	3

## COURSES WITH DESCRIPTION IN CHEMISTRY

### Advanced Undergraduate and Graduate

#### **CHEM-610. Inorganic Synthesis**

**Credit 2 (1-3)**

Discussion of theoretical principles of synthesis and development of manipulative skills in the synthesis of inorganic substances. Prerequisites: One year of organic chemistry; one semester of quantitative analysis.

#### **CHEM-611. Advanced Inorganic Chemistry**

**Credit 3 (3-0)**

A course in the theoretical approach to the systematization of inorganic chemistry. Prerequisite: Chemistry 442.

#### **CHEM-621. Intermediate Organic Chemistry**

**Credit 3 (3-0)**

An in-depth examination of various organic mechanisms, reactions, structures, and kinetics. Prerequisite: Chemistry 222.

#### **CHEM-624. Qualitative Organic Chemistry\***

**Credit 5 (3-6)**

A course in the systematic identification of organic compounds. Prerequisite: One year of Organic Chemistry.

#### **CHEM-631. Electroanalytical Chemistry**

**Credit 3 (3-0)**

A study of the theory and practice of polarography, chronopotentionmetry, potential sweep chronoampereometry and electrodeposition. The theory of diffusion and electrode kinetics will also be discussed along with the factors that influence rate processes, the double layer, absorption and catalytic reactions. Prerequisite: Chemistry 431 or equivalent.

#### **CHEM-641. Radiochemistry**

**Credit 3 (3-0)**

A study of the fundamental concepts, processes, and applications of nuclear chemistry, including natural and artificial radioactivity, sources, and chemistry of the radioelements. Open to advanced majors and others with sufficient background in chemistry and physics. Prerequisite: Chemistry 442 or Physics 406.

#### **CHEM-642. Radioisotope Techniques and Applications**

**Credit 2 (1-3)**

The techniques of measuring and handling radioisotopes and their use in chemistry, biology, and other fields. Open to majors and non-majors. Prerequisite: Chemistry 102 or 105 or 107.

#### **CHEM-643. Introduction to Quantum Mechanics**

**Credit 4 (4-0)**

Non-relativistic wave mechanics and its application to simple systems of means of the operator formulation. Prerequisites: Chemistry 442 and Physics 222. Corequisite: Mathematics 300.

#### **CHEM-651. General Biochemistry**

**Credit 3 (3-0)**

A study of modern biochemistry. The course emphasizes chemical kinetics and energetics associated with biological reactions and includes a study of carbohydrates, lipids, proteins, vitamins, nucleic acids, hormones, photosynthesis, and respiration. Prerequisites: Chemistry 431 and 442.

#### **CHEM-652. General Biochemistry**

**Credit 3 (3-0)**

This is a companion laboratory to Chemistry 651. Experimentation will include isolation and characterization of biochemical substances as well as studies of physical properties. Students will be introduced to a variety of techniques including high performance liquid chromatography, electrophoresis, and centrifugation. Corequisite: Chemistry 651. Prerequisites: Chemistry 432 and 444.

*\* Students are required to purchase supplemental materials for this course.*



## INORGANIC CHEMISTRY

### Graduate

#### **CHEM-711. Structural Inorganic Chemistry**

**Credit 3 (3-0)**

A study of the stereochemistry and electronic properties of inorganic substances. Emphasis will be placed upon applications of group theory and upon spectroscopic and physical methods.

#### **CHEM-716. Selected Topics in Inorganic Chemistry**

**Credit 3 (3-0)**

A lecture course on advanced topics of Inorganic Chemistry. Prerequisite: Chemistry 611 or permission of the instructor.

## ORGANIC CHEMISTRY

### Graduate

#### **CHEM-721. Elements of Organic Chemistry**

**Credit 3 (2-3)**

A systematic study of the classes of aliphatic and aromatic compounds and individual examples of each. Structure, nomenclature, synthesis, and characteristic reactions will be considered. Illustration of the familiarity of organic substances in everyday life will be included. In the laboratory, preparation and characterization reactions will be performed.

#### **CHEM-722. Advanced Organic Chemistry**

**Credit 3 (3-0)**

Recent developments in the areas of structural theory, stereochemistry, molecular rearrangement and mechanism of reactions of selected classes of organic compounds. Prerequisite: One year of Organic Chemistry or Chemistry 721.

#### **CHEM-723. Organic Chemistry**

**Credit 2 (2-0)**

An advanced treatment of organic reactions designed to give the students a working knowledge of the scope and limitations of the important synthetic methods of Organic Chemistry. Prerequisite: Chemistry 722.

#### **CHEM-726. Selected Topics in Organic Chemistry**

**Credit 3 (3-0)**

A lecture course on advanced topics in Organic Chemistry.

#### **CHEM-727. Organic Preparations**

**Credit 1-2 (0-2 to 4)**

An advanced laboratory course. Emphasis is placed on the preparation and purification of more complex organic compounds. Prerequisite: One year of Organic Chemistry.

## BIOCHEMISTRY

### Graduate

#### **CHEM-756. Selected Topics in Biochemistry**

**Credit 3 (3-0)**

A lecture course on advanced topics in Biochemistry.

## ANALYTICAL CHEMISTRY

### Graduate

#### **CHEM-731. Modern Analytical Chemistry**

**Credit 3 (2-3)**

The theoretical bases of Analytical Chemistry are presented in detail. In the laboratory, these principles, together with a knowledge of chemical properties, are used to identify substances and estimate quantities in unknown samples.

**CHEM-732. Advanced Analytical Chemistry****Credit 3 (3-0)**

A lecture course in which the theoretical bases of Analytical Chemistry and their application in analysis will be reviewed with greater depth than is possible in the customary undergraduate courses. Equilibrium processes, including proton and electron transfer reactions and matter-energy interactions, will be considered. Prerequisite: One year of Analytical Chemistry or Chemistry 731.

**CHEM-736. Selected Topics in Analytical Chemistry****Credit 3 (3-0)**

A lecture course on advanced topics in Analytical Chemistry.

**PHYSICAL CHEMISTRY****Graduate****CHEM-741. Principles of Physical Chemistry I****Credit 3 (3-0)**

A review of the fundamental principles of Physical Chemistry, including the derivation of the more important equations and their application to the solution of problems. Prerequisite: Mathematics 606 or 622.

**CHEM-742. Principles of Physical Chemistry II****Credit 3 (3-0)**

A continuation of Chemistry 741. May be taken concurrently with Chemistry 741.

**CHEM-743. Chemical Thermodynamics****Credit 3 (3-0)**

An advanced course in which the laws of thermodynamics will be considered in their application to chemical processes. Prerequisite: Chemistry 442 or 742.

**CHEM-744. Chemical Spectroscopy****Credit 3 (2-3)**

An advanced course in which the principles and applications of spectroscopy will be considered. Prerequisite: Chemistry 442 or 742.

**CHEM-746. Selected Topics in Physical Chemistry****Credit 3 (3-0)**

A lecture course on advanced topics in Physical Chemistry. Prerequisite: Chemistry 442 or 742.

**CHEM-748. Colloid Chemistry****Credit 2 (2-0)**

A study of the types of colloidal systems and the fundamental principles governing their preparation and behavior. Prerequisite: Chemistry 442 or 742.

**CHEM-749. Chemical Kinetics****Credit 4 (4-0)**

A study of the theory of rate processes; application to the study of reaction mechanisms. Prerequisites: Mathematics 222 and Chemistry 442 or 742.

**RESEARCH AND SPECIAL PROBLEMS****Graduate****CHEM-701. Seminar****Credit 1 (1-0)**

Presentation and discussion of library or laboratory research problems.

**CHEM-702. Chemical Research****Credit 2-5 (0.6 to 15)**

A course designed to permit qualified students to do original research in chemistry under the supervision of a senior staff member. May be taken for credit more than once.

**CHEM-715. Special Problems in Inorganic Chemistry****Credit 1 (0-2)**

A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Inorganic Chemistry. May be taken for credit more than once.

<b>CHEM-725. Special Problems in Organic Chemistry</b>	<b>Credit 1 (0-2)</b>
A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Organic Chemistry. May be taken for credit more than once.	
<b>CHEM-735. Special Problems in Analytical Chemistry</b>	<b>Credit 1 (0-2)</b>
A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Analytical Chemistry. May be taken for credit more than once.	
<b>CHEM-745. Special Problems in Physical Chemistry</b>	<b>Credit 1 (0-2)</b>
A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Physical Chemistry. May be taken for credit more than once.	
<b>CHEM-755. Special Problems in Biochemistry</b>	<b>Credit 1 (0-2)</b>
A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in Biochemistry. May be taken for credit more than once.	
<b>CHEM-663. Selected Topics in Chemistry Instruction I</b>	<b>Credit 1 (1-0)</b>
A study of the curriculum and educational materials developed for use in the Thirteen College Curriculum Program in Physical Science.	
<b>CHEM-664. Selected Topics in Chemistry Instruction II</b>	<b>Credit 1 (1-0)</b>
A continuation of Chemistry 763.	
<b>CHEM-765. Special Problems in Chemistry Instruction I</b>	<b>Credit 3 (3-0)</b>
A course designed to introduce students to techniques of Chemistry instruction at the college level.	
<b>CHEM-766. Special Problems in Chemistry Instruction II</b>	<b>Credit 3 (3-0)</b>
A continuation of Chemistry 765.	
<b>CHEM-767. Special Problems in Chemistry Instruction III</b>	<b>Credit 3 (3-0)</b>
A continuation of Chemistry 766.	
<b>CHEM-799. Masters Level Research in Chemistry</b>	<b>Credit 3 (3-0)</b>

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### OBJECTIVE

The objective of the Civil Engineering graduate program is to provide educational opportunities to professionals in the Piedmont Triad area for advanced study and research in two concentration areas: Environmental/Water Resources Engineering and Civil Infrastructure Systems Engineering.

### DEGREE OFFERED

Master of Science in Civil Engineering

### ADMISSION REQUIREMENTS

All applicants for graduate study must have earned a bachelor's degree from a four-year accredited college. Prospective students must follow all current procedures of the School of Graduate Studies.

The minimum requirement for unconditional admission to the Master of Science in Civil Engineering Program will be an undergraduate degree from an ABET accredited Civil Engineering program with a minimum of 3.0 (out of 4.0) Grade Point Average on the overall undergraduate program of study. The other two categories of admission, provisional and special student, may also be used on a case-by-case basis as described below.

Persons may be admitted provisionally to the MSCE program if any of the following conditions apply:

1. The undergraduate degree is not from an ABET accredited program in civil engineering.
2. The undergraduate degree is not engineering but in a closely related curriculum with a substantial engineering science content.
3. Deficiencies revealed in the analysis of the undergraduate transcript may be removed by the inclusion of no more than 12 semester credit hours.

A student admitted provisionally would be required to meet with the Coordinator of Graduate Programs to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate preparation for graduate study. All provisionally admitted students must earn a 3.0 grade point average on the first nine graduate course credits completed. In addition, a 3.0 grade point average must be earned on all undergraduate courses if any were required as a condition of admission.

Students who do not hold an engineering undergraduate degree may have course deficiencies exceeding 12 semester credits. These students can be considered for special student status until such time that their deficiencies are reduced so that they can qualify for provisional admission. Persons with massive undergraduate deficiencies, even though they might hold an undergraduate degree, are asked to apply as transfer students to the undergraduate Civil Engineering program. Make-up courses will be evaluated on a case-by-case basis dependent on the student's area of interest.



Students who are not seeking a graduate degree at NORTH CAROLINA A&T are also classified as special students. They are admitted to take courses for self-improvement. If a student subsequently wishes to pursue a degree program, he/she must request an evaluation of his/her record. The School of Graduate Studies reserves the right to refuse to accept credits earned while being enrolled as a special student towards a degree program; under no circumstances may the student apply towards a degree program more than twelve semester hours of graduate credits earned as a special student.

In addition to the above application material, foreign nationals or people whose mother tongue is not English are required to provide special information concerning English proficiency and finances. Specifically, these applicants are required to take the standardized "Test of English as a Foreign Language" (TOEFL) and achieve a minimum score of 550.

The School of Graduate Studies accepts application from students who already hold a Master's degree in other fields or disciplines, but wish to earn a MSCE degree.

Consistent with NORTH CAROLINA A&Ts School of Graduate Studies Policy, applicants holding a Master's degree in another engineering discipline from NORTH CAROLINA A&T need only complete 18 credit hours to earn a MSCE degree. If the applicant holds an engineering Master's degree from outside NORTH CAROLINA A&T, a maximum of 6 credit hours of course work may be transferred.

## **GENERAL DEPARTMENTAL REQUIREMENTS**

A student pursuing a Master of Science in Civil Engineering has the following three options:

- 1) All course work option
- 2) Project option, and
- 3) Thesis option

All students pursuing a Master of Science in Civil Engineering must complete at least one (1) course of the group of Core Courses, six credit hours of advanced math courses (or equivalent math courses), and must enroll in the Masters Seminar (CIEN 792) every semester in residence.

### **Civil Engineering Core Courses**

CIEN 644	Finite Element Analysis
CIEN 700	Emerging Technologies in Civil Engineering
CIEN 702	Civil Engineering System Analysis
CIEN 721	Advanced Soil Testing for Engineering Purposes

### **Requirements of the Different Options**

All options require a minimum of thirty (30) credit hours and the formation of a formal graduate committee. The graduate committee will consist of the advisor and two additional faculty members selected in agreement between the advisor and the student. The plan of study should be prepared by the student and must be approved by the graduate committee. Specifically, only the courses approved by the graduate committee can be used to satisfy the minimum requirements set forth as "approved course work." At least half of the credit hours counted in the "approved course work" to satisfy the requirements for a master's degree must be 700 level courses; that is, courses open only to graduate students. Furthermore, the courses numbers 790 and above cannot be used to satisfy the "approved course work" requirements, with the only exceptions as listed below:

**All Course Work Option:** This option requires thirty (30) credit hours of “approved course work” plus a comprehensive examination that would be administered by the student’s graduate committee during the last semester in residence.

**Project Option:** The project option requires twenty-seven (27) credit hours of “approved course work” and three credit hours of the Masters Project (CIEN 796). This option is intended for students wishing to investigate a design problem of current interest to industry or to pursue a practical application. These students will have to demonstrate to the committee their capacity to perform and report work adequately.

**Thesis Option:** This option requires twenty-four (24) credit hours of “approved course work” and six (6) credit hours of Masters Thesis (CIEN 797). The student’s graduate committee must formally examine the thesis content and quality, and judge the thesis defense. Furthermore, the thesis should follow the format required by the School of Graduate Studies.

## Grades Required

Grades for graduate students are recorded as follows: A, excellent; B, average; C, below average, but permissible; D, clearly below average and not acceptable; F, failure; S, satisfactory; U, unsatisfactory (all courses CIEN 792 through CIEN 797 will be assigned S or U and will not be counted in the student’s GPA); I, incomplete; W, withdrawal. The following academic requirements are proposed:

1. To earn a degree, a student must have a cumulative average of “B” (3.0 on the 4.0 system).
2. A graduate student is automatically placed on “warning” when his/her cumulative average falls below “B”. The student has one semester to raise his/her average to “B” or above or be placed on Probation. Probationary status will remove a student’s eligibility for a teaching assistantship.
3. A student may be dropped from the degree program if he/she has not achieved a cumulative GPA of 3.0 at the end of the probationary semester.
4. A student may not repeat a required course in which “C” or above was earned.
5. A student may repeat a required course in which “F” was earned. A student may not repeat the course more than once. If a student achieves less than “C” the second time, he/she is dismissed from the degree program.
6. All hours attempted in graduate courses and all grade points earned are included in the computation of the cumulative average of a graduate student.
7. A student who stops attending a course but fails to withdraw officially will be assigned a grade of “F”
8. All grades of “I” must be removed during the next semester within the prescribed time period.
9. Changing the selected option, for example from thesis to project, requires approval of the Graduate advisor and the Coordinator of Graduate Programs and may lead to loss of credit for thesis or project credits.

The graduate program must be completed within six (6) consecutive calendar years. Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for outdated work. In the event that studies are interrupted for duty in the armed services, the time limit shall be extended for the length of time the student shall have been on active duty providing the candidates resumes graduate work no later than one year following release from military services.

## Advanced Undergraduate/Graduate Courses

Course	Title	Credit
CIEN 600	Expert Systems Applications in Civil Engineering	3 (3-0)
CIEN 610	Water and Wastewater Analysis	3 (3-0)
CIEN 614	Stream Water Quality Modeling	3 (3-0)
CIEN 616	Solid Waste Management	3 (3-0)
CIEN 618	Air Pollution Control	3 (3-0)
CIEN 620	Foundation Design I	3 (3-0)
CIEN 622	Soil Behavior	3 (3-0)
CIEN 624	Seepage and Earth Structures	3 (3-0)
CIEN 626	Soil and Site Improvement	3 (3-0)
CIEN 628	Applied Geotechnical Engineering Analysis and Design	3 (3-0)
CIEN 630	Advanced Construction Materials	3 (1-6)
CIEN 640	Advanced Structural Analysis	3 (3-0)
CIEN 641	Design of Reinforced Concrete Structures	3 (3-0)
CIEN 642	Design of Prestressed Concrete Structures	3 (3-0)
CIEN 644	Finite Element Analysis I	3 (3-0)
CIEN 646	Structural Design in Steel	3 (3-0)
CIEN 648	Structural Design in Wood	3 (3-0)
CIEN 650	Geometric Design in Highways	3 (3-0)
CIEN 652	Urban Transportation Planning	3 (3-0)
CIEN 656	Traffic Engineering	3 (2-2)
CIEN 658	Pavement Design	3 (3-0)
CIEN 660	Water Resources System Analysis	3 (3-0)
CIEN 662	Water Resources Engineering	3 (3-0)
CIEN 664	Open Channel Flow	3 (3-0)
CIEN 668	Subsurface Hydrology	3 (3-0)
CIEN 670	Construction Engineering and Management	3 (3-0)
CIEN 699	Special Projects	3 (3-0)
CIEN 700	Emerging Technologies in Civil Engineering	3 (3-0)
CIEN 702	Civil Engineering Systems Analysis	3 (3-0)
CIEN 710	Hazardous Waste Management	3 (3-0)
CIEN 712	Systems Approach in Waste Management	3 (3-0)
CIEN 720	Theoretical Soil Mechanics	3 (3-0)
CIEN 721	Advanced Soil Testing for Engineering Purposes	3 (3-0)
CIEN 722	Design of Reinforced Earth Structures	3 (3-0)
CIEN 724	Constitutive Modeling for Geological Media	3 (3-0)
CIEN 726	Foundation Design II	3 (3-0)
CIEN 729	Geotechnical Aspects of Earthquake Engineering	3 (3-0)
CIEN 752	Public Transportation Systems	3 (3-0)
CIEN 754	Modeling of Transportation Systems	3 (3-0)
CIEN 756	Highway Operations and Safety	3 (3-0)
CIEN 766	Design of Hydraulic Structures and Machinery	3 (3-0)
CIEN 785	Selected Topics	1 (1-0), 2 (2-0), 3 (3-0)
CIEN 786	Special Projects	1 (1-0), 2 (2-0), 3 (3-0)
CIEN 792	Civil Engineering Masters Seminar	1 (1-0)
CIEN 793	Masters Supervised Teaching	3 (3-0)
CIEN 794	Masters Supervised Research	3 (3-0)

## **COURSES WITH DESCRIPTION IN CIVIL & ENVIRONMENTAL ENGINEERING**

### **Advanced Undergraduate and Graduate**

#### **CIEN-600. Expert Systems Applications in Civil Engineering      Credit 3 (3-0)**

Introductory overview of artificial intelligence with an emphasis on Civil Engineering applications: What they are, how they are applied today, a discussion of when they should and should not be used and what goes into building them. Emphasis is on: task selection criteria, knowledge acquisition and modeling, expert system architectures (control and representation issues), and testing and validation. Course requirements will include the design and development of a working system in a chosen application area.

#### **CIEN-610. Water and Wastewater Analysis      Credit 3 (3-0)**

Laboratory and field methods for the measurements and analysis of water.

#### **CIEN-614. Stream Water Quality Modeling      Credit 3 (3-0)**

Mathematical modeling of water quality in receiving streams. Topics include: The generation of point and nonpoint sources of pollutants; the modeling and prediction of the reaction, transport and fate of pollutants in the stream; and the formulation and solution of simulation models. (Spring)

#### **CIEN-616. Solid Waste Management      Credit 3 (3-0)**

This course is the study of collection, storage, transport and disposal of solid wastes. Examination of various engineering alternatives with appropriate consideration for air and water pollution control and land reclamation are emphasized. (Fall)

#### **CIEN-618. Air Pollution Control      Credit 3 (3-0)**

Introduction to air pollution and its control. Topics include: sources, types, and characteristics of air pollutants; air quality standards; and engineering alternatives for achieving various degrees of air pollution control.

#### **CIEN-620. Foundation Design I      Credit 3 (3-0)**

This course will introduce the following topics: behavior and design of retaining walls and shallow foundations; earth pressure; bearing capacity and settlement; stress distribution and consolidation theories; settlement of shallow foundations.

#### **CIEN-622. Soil Behavior      Credit 3 (3-0)**

This course will introduce the following topics: behavior of soil examined from a fundamental perspective; review of methods of testing to define response, rationale for choosing shear strength and deformation parameters for soils for design applications.

#### **CIEN-624. Seepage and Earth Structures      Credit 3 (3-0)**

This course will introduce the following topics: seepage through soils; permeability of soils; embankment design; compaction; earth pressures and pressures in embankments; slope stability analysis; settlements and horizontal movements in embankments; and landslide stabilization.

#### **CIEN-626. Soil and Site Improvement      Credit 3 (3-0)**

This course will introduce the following topics: methods of soil and site improvement; design techniques for dewatering systems; grouting; reinforced earth; in-situ densification; stone columns; slurry trenches; and the use of geotextiles. Construction techniques for each system are described.



**CIEN-628. Applied Geotechnical Engineering Analysis and Design**

**Credit 3 (3-0)**

Introductory course in subsurface hydrology including: Principles of fluid (water) in saturated and unsaturated materials, well hydraulics, various methods of subsurface water flow systems, infiltration theory, and schemes for ground water basin management.

**CIEN-630. Advanced Construction Materials**

**Credit 3 (1-6)**

This course covers Construction Materials advanced topics. It includes the chemistry, biology, physics, microstructure and macrostructure of many materials used in construction. Plastics, Portland cement concrete, asphalt cement and asphalt cement concrete, rubber, glazing, masonry, insulation materials, and wood are all covered in some detail. The relationship between materials and their appropriate use in service is stressed. There is substantial hands-on laboratory work involved, including mixing and testing.

**CIEN-640. Advanced Structural Analysis**

**Credit 3 (3-0)**

This course is a continuation of CIEN-340 emphasizing the more complex concepts of structural analysis for determinate and indeterminate structural systems using both hand calculations and computer applications.

**CIEN-641. Design of Reinforced Concrete Structures**

**Credit 3 (3-0)**

This course is a continuation of CIEN-540 emphasizing the more complex concepts of reinforced concrete design. The design of continuous beams, two slabs and beams columns are addressed.

**CIEN-642. Design of Prestressed Concrete Structures**

**Credit 3 (3-0)**

This course uses the ACI and AASHTO codes to analyze and design prestressed concrete structures.

**CIEN-644. Finite Element Analysis I**

**Credit 3 (3-0)**

Analysis of continuous structural systems as assemblages of discrete elements. Applications of the finite element method is made to the general field of continuum mechanics. Convergence properties and numerical techniques are discussed.

**CIEN-646. Structural Design in Steel**

**Credit 3 (3-0)**

This course uses the AISC code to analyze and design steel structures.

**CIEN-648. Structural Design in Wood**

**Credit 3 (3-0)**

This course uses the wood product code to analyze and design wood structures.

**CIEN-650. Geometric Design of Highways**

**Credit 3 (3-0)**

This course deals with the development and application of geometric design concepts for rural systems. Topics include: functional classifications, design controls and criteria, elements of design, cross section elements, and intersection design.

**CIEN-652. Urban Transportation Planning**

**Credit 3 (3-0)**

This course introduces urban transport planning using a decision oriented approach. Discussions focus on the decision making process, data requirements, evaluation processes, systems performance analysis and program implementation.

**CIEN-656. Traffic Engineering**

**Credit 3 (2-2)**

Theory and practice of the operation aspects of Transportation Engineering. Specific applications will deal with the operation, design, and control of highways and their networks. Topics include: data collection techniques, traffic flow theory, and various highway capacity methods and their theoretical basis and the various application software available for each topic.

**CIEN-658. Pavement Design****Credit 3 (3-0)**

Application of multilayer theories for design of highways and airport pavement structures. Flexible and rigid pavement design methods are covered with discussions focusing on their theoretical basis and their major differences. Topics include; cost analysis and pavement selection, drainage, earthwork, pavement evaluation, and maintenance.

**CIEN-660. Water Resources System Analysis****Credit 3 (3-0)**

Mathematical modeling techniques. Formulation of mathematical representations of complex water resources systems and their evaluation via linear programming, dynamic programming, non-linear programming, and by the use of formal heuristics. Models for optimal sewer design, optimal sequencing (or capacity expansion) of projects, reservoir systems planning and management are presented.

**CIEN-622. Water Resource Engineering****Credit 3 (2-2)**

This course involves the application of hydrologic and hydraulic principles in the analysis and design of water resources systems. The measurement of ground water parameters and general water quality parameters is covered. Topics covered include; water supply and distribution, reservoirs, water resources system economics, water law, hydroelectric power, flood control, water resources planning and development and drainage.

**CIEN-664. Open Channel Flow****Credit 3 (3-0)**

Advanced topics in open channel flow, design of open channels for uniform and nonuniform flow, wave interference, roughness effects, flow over spillways, water surface profiles, and energy dissipation methods. Some computational methods in open channel flow are presented.

**CIEN-668. Subsurface Hydrology****Credit 3 (3-0)**

Introductory course in subsurface hydrology including; principles of fluid (water) in saturated and unsaturated materials, well hydraulics, various methods of subsurface water flow systems, infiltration theory, and schemes for ground-water basin management.

**CIEN-670. Construction Engineering and Management****Credit 3 (3-0)**

This course concentrates on the solution to problems in Construction Engineering and Management. A variety of problems from the construction industry are presented to the students. The students form teams to develop solutions to these problems. Topics vary with available projects and student interest. Graduate students select a project in their area of interest for intensive study and a report.

**CIEN-699. Special Projects****Credit 3 (3-0)**

Study arranged on a special civil engineering topic of interest to the student and faculty. Topics may be analytical and/or experimental with independent study encouraged.

**GRADUATE STUDENTS ONLY****CIEN-700. Emerging Technologies in Civil Engineering****Credit 3 (3-0)**

Provides an overview of the applications of emerging technologies (such as decision support systems and Geographic Information Systems) in civil engineering. The students are required to complete a project which includes the design and implementation of one of the types of systems covered in the course.

**CIEN-702. Civil Engineering Systems Analysis****Credit 3 (3-0)**

Introduces mathematical modeling techniques for the solution of civil engineering problems. These include the formulation of mathematical representation of complete civil engineering systems and their evaluation via linear programming, dynamic programming, non-linear pro-

gramming and the use of formal heuristics. Multiobjective analysis, project management and civil engineering planning and design are also presented.

**CIEN-710. Hazardous Waste Management**

**Credit 3 (3-0)**

Presents a study of the characteristics, treatment, and disposal of hazardous wastes. The topics include the: the generation and characteristics of hazardous waste, hazardous waste regulations, transport and fate of hazardous waste in the environment and treatment and disposal methods. (Fall)

**CIEN-712. Systems Approach in Waste Management**

**Credit 3 (3-0)**

Introduces the application of systems analysis methods to the design, analysis and management of environmental systems. The topics include: Characteristics of a system, problems amenable to systems analysis, optimization models, solution techniques, and case studies in solid waste management, hazardous waste management, and water quality management. (Spring)

**CIEN-720. Theoretical Soil Mechanics**

**Credit 3 (3-0)**

Presents the different theories of consolidation, such as Terzaghi's Theory, layered systems, sand drains, approximate three-dimensional theories, and Biot's poroelastic formulation. The course will also present theories of elastic and plastic equilibrium in soils including applications to earth pressure, bearing, bearing capacity, and slope stability problems.

**CIEN-721. Advanced Soil Testing for Engineering Purposes**

**Credit 3 (1-6)**

This course allows students to gain laboratory experience with the methods of testing soils for engineering properties such as compressibility, strength (in triaxial, simple shear, and direct shear), permeability, and stability.

**CIEN-722. Design of Reinforced Earth Structures**

**Credit 3 (3-0)**

Introduces the student to the interaction mechanisms of soil with reinforcement elements. The applications covered will include the following: reinforced earth, soil nailing, and geotextile/geofabric strengthening of pavement structures.

**CIEN-724. Constitutive Modeling for Geological Media**

**Credit 3 (3-0)**

Introduces the following topics: constitutive models for geological media including piecewise linear; Mohr-Coulomb; Hvorslev's and Roscoe's concepts; role in modeling of in-situ stress; sequential construction and stress paths; lateral pressure coefficients; dilatation and softening; arching; pore water pressure; joints and interfaces; and Darcy and non Darcy Laws.

**CIEN-726. Foundation Design II**

**Credit 3 (3-0)**

Introduce the analysis and design of foundations and other substructures including the following: concrete footings with reinforcement; pile foundations; retaining walls; pavements, load transfer in rail track beds; cofferdams; caissons and underground structures and openings.

**CIEN-729. Geotechnical Aspects of Earthquake Engineering**

**Credit 3 (3-0)**

Introduces the student to the following earthquake related topics: response of soils to seismic loading; liquefaction phenomena and analysis of pore pressure development; laboratory testing for seismic, including direct laboratory experience. The course will also provide instruction on the analysis and design of slopes, embankments, foundations, and earth retaining structures for seismic loading conditions.

**CIEN-752. Public Transportation Systems**

**Credit 3 (3-0)**

Exposes the student to the technologies, design, operation, planning, evaluation, management and implementation of public transportation systems. The following systems are considered: rail, fixed-route, fixed-schedule bus, and demand responsive services. The topics include the



following: financing and regulation, supply and demand relationships, performance evaluation, routing and scheduling, and microcomputer applications.

**CIEN-754. Modeling of Transportation Systems**

**Credit 3 (3-0)**

This course is concerned with the development and use of system models associated with transportation decision making. The modeling techniques that will be used are the following: multiple linear regressions, choice theory and network simulation. The application areas considered are the following: traffic flow theory, planning models, urban transit planning and operations, and the evaluation alternatives.

**CIEN -756. Highway Operations and Safety**

**Credit 3 (3-0)**

This course will present a discussion of the policies, laws and programs relating to highway safety in the United States. The topics of discussion presented include a historical overview of highway safety, the government's role (at all levels), a description and status of current safety programs, the analytical techniques used by the traffic safety engineer (practical problems, data requirements, limitations), and some of the moral/ethical issues of concern to the Safety Engineer.

**CIEN-766. Design of Hydraulic Structures and Machinery**

**Credit 3 (3-0)**

Presents the analysis and design of water regulating structures including dams, spillways, outlet works, transition structures, conduit systems and gates. Will also present the applications of basic principles of fluid mechanics and hydraulics to the design and selection of pumps, turbine, and other hydraulic machinery.

**CIEN-785. Selected Topics**

**Credit 1 (1-0), 2 (2-0), 3 (3-0)**

Allows a student to select a civil engineering topic of interest to the student to investigate in depth. The topic will be selected by the student and a faculty advisor before the beginning of the semester. The topic must be pertinent to the study program of the student and must be approved by the faculty advisor.

**CIEN-786. Special Projects**

**Credit 1 (1-0), 2 (2-0), 3 (3-0)**

Student must select a project on a special civil engineering topic of interest to the student and a faculty member, who will act as an advisor. The student and faculty advisor must agree upon the project and scope of work before the beginning of the semester. The project may be analytical and/or experimental and encourage independent work. The topic must be pertinent to the program in which the student is enrolled and approved by the faculty advisor. (Fall, Spring)

**CIEN-792. Civil Engineering Masters Seminar**

**Credit 1 (1-0)**

Discussions and reports of subjects in Civil Engineering and allied fields will be presented.

**CIEN-793. Masters Supervised Teaching**

**Credit 3 (3-0)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment.

**CIEN-794. Masters Supervised Research**

**Credit 3 (3-0)**

Students will receive instruction in how to plan, organize and perform research. Research will be performed under the mentorship of a member of the graduate faculty.

**CIEN-796. Masters Project**

**Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students.



**CIEN-797. Masters Thesis****Credit 3 (3-0)**

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Master's Thesis. This course is only available to thesis option students.

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## Computer Science Department

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### OBJECTIVES

The Master of Science Program in Computer Science is designed to meet the need for technical and managerial specialist in research, academia and industry.

### DEGREE OFFERED

Computer Science - Master of Science

The MSCS program provides three methods for earning the degree; Thesis (30 credits), Project (33 credits) or course only (33 credits). Unconditional admission to the program is granted to students with a BS in computer science from an accredited program with a minimum GPA of 3.0. Admission may be awarded to promising students from other majors after completing specified undergraduate prerequisites. Specific degree and admissions requirements are detailed in the Computer Science Department Graduate Student Handbook.

It is assumed that all entering students have completed undergraduate courses in programming in an object-oriented language (such as C++, Java or Smalltalk), in data structures, algorithm analysis, operating systems and computer architecture, as well as mathematical maturity (for example, calculus, discrete math or switching theory). Students who have not had such courses or their equivalent may be required to take undergraduate courses to remedy deficiencies, with no credit towards the degree.

### Master's Program General Description

The research interests of the faculty cover many areas of Computer Science including software engineering, artificial intelligence, distributed systems, multiagent systems, multimedia input and high performance computing.

#### *Software Engineering:*

"The systematic approach to the development, operation, maintenance, and retirement of software" is the definition of software engineering. Software is not only the program code, but includes the various documents needed for the development, installation, utilization, and maintenance of a system. Engineering refers to the application of a systems approach to the production of large software systems. Methodologies for analysis and design are evolving, competing, and themselves being automated through the use of CASE (computer aided software engineering) tools. The methods of software engineering seek to produce systems of high quality, on time, at the lowest costs possible. Research projects include object oriented methodologies, software production cost modeling, software reliability engineering, and the social implications of computer technology.

## *Artificial Intelligence:*

Artificial intelligence uses symbolic computation and complex interrelations of variables to produce "intelligent" responses to problem situations. The responses are intelligent in the sense that unforeseen situations are accommodated and decisions are not hard-coded into programs. Problems are frequently "ill-structured", that is, they cannot be stated in the forms required by commonly used deterministic and sequential algorithms. Artificial intelligence often involves search and inference and frequently supports human decision making. It is thus natural to view artificial intelligence software as tackling problems as humans would tackle them. Research topics include mobile robots, computer vision, automated reasoning, the acquisition and representation of knowledge, and the analysis of decision making in realistic business settings. Artificial intelligence uses a multitude of paradigms, willingly collaborates with other areas of computer science, and pursues real-world applications.

The Computer Science Department operates the Software Engineering Laboratory, the Generic Object Oriented Software Engineering Laboratory (IBM Software Solutions), the NASA Intelligent Agents study group, and other research funded by agencies including the Air Force, the Naval Oceanographic Office, and the National Security Agency.

### **LIST OF GRADUATE COURSES**

COMP 645	Artificial Intelligence
COMP 650	Advanced Operating Systems *
COMP 653	Computer Graphics
COMP 662	Computer Aided Instruction #
COMP 663	Compiler Construction †
COMP 670	Advanced Computer Architecture
COMP 681	Formal Methods
COMP 685	Advanced Design and Analysis of Algorithms *
COMP 691	Independent Study
COMP 696	Information, Privacy, and Security #
COMP 710	Software Specification, Analysis and Design ***
COMP 711	Software System Design, Implementation, Verification & Validation ***
COMP 712	Software Project Management ***
COMP 713	Social Impacts of Software Systems †#
COMP 714	Case, Automated Development, & Information Engineering #
COMP 715	Decision Support Systems †#
COMP 717	Software Fault Tolerance #
COMP 718	Object Oriented Software Engineering #
COMP 719	Software Reuse Techniques #
COMP 740	Advanced Artificial Intelligence **
COMP 741	Knowledge Representation and Acquisition **
COMP 742	Automated Reasoning †
COMP 745	Computational Linguistics †
COMP 747	Computer Vision Methodologies †
COMP 749	Intelligent Robots †
COMP 750	Distributed Systems †#
COMP 753	Performance Modeling and Evaluation †#
COMP 767	Computer Network Architecture #
COMP 780	Semantics of Programming Languages
COMP 790	Special Topics in Computer Science

COMP 792	Computer Science Masters Seminar †
COMP 793	Masters Supervised Teaching
COMP 796	Masters Project
COMP 797	Masters Thesis

\* = Core course, required of all students

\*\* = Required for Artificial Intelligence specialization

\*\*\* = Required for Software Engineering specialization

† = Approved AI specialization elective

# = Approved SE specialization elective

+ = Required every semester for full time students

## COURSES WITH DESCRIPTION IN COMPUTER SCIENCE

### Advanced Undergraduate and Graduate

#### **COMP-600. Special Topics in Computer Science**

**Credit 3 (3-0)**

This is a seminar surveying fundamental concepts and current ideas in computer science. Students shall select, research, and present topics of their interest.

#### **COMP-645. Artificial Intelligence**

**Credit 3 (3-0)**

This course presents the theory of artificial intelligence, and application of the principles of artificial intelligence to problems that cannot be solved, or cannot be solved efficiently, by standard algorithmic techniques. Knowledge representation, and Knowledge-based systems. Topics include search strategies, production systems, heuristic search, expert systems, inference rules, computational logic, natural language processing. Predicate calculus is discussed. An artificial intelligence language is presented as a vehicle for implementing concepts of artificial intelligence.

#### **COMP-650. Advanced Operating Systems**

**Credit 3 (3-0)**

This course centers on operating systems for multi-processing environments: concurrent processes, mutual exclusion, job scheduling, memory, storage hierarchy, file systems, security, and distributed processing. Also discussed are virtual resource management strategies. A design project involving the construction of operating facilities is produced.

#### **COMP-653. Computer Graphics**

**Credit 3 (3-0)**

This is a course in fundamental principles and methods in the design, use, and understanding of computer graphic systems. Topics include coordinate representations, graphics functions, and software standards. Hardware and software components of computer graphics are discussed. The course presents graphics algorithms. It also introduces basic two-dimensional transformations, reflection, shear; windowing concepts, clipping algorithms, window-to-view-port transformations, segment concept, files, attributes and multiple workstation, and interactive picture-construction techniques.

#### **COMP-663. Principles of Compiler Design**

**Credit 3 (3-0)**

This course emphasizes the theoretical and practical aspect of constructing compilers for computer programming languages. The course covers principles, models, and techniques used in the design and implementation of compilers, interpreters, and assemblers. Topics include lexical analysis, parsing arithmetic expressions and simple statements, syntax specification, algorithms for syntax analysis, object code generation, and code optimization. Each student will develop and implement a compiler.



**COMP-670. Advanced Computer Architecture****Credit 3 (3-0)**

This is a course that examines the control and storage structures that facilitate the execution and management of logically segmented programs and data. Of special focus are input output mechanisms, performance tuning, and microprogramming.

**COMP-681. Formal Methods****Credit 3 (3-0)**

In this course, formal methods that model the software development process will be studied. Fundamental and practical methodologies and theories, including set theory and the foundations of software engineering will be emphasized. Applications to formal specifications, object-oriented programming and data modeling will be examined. Topics include: set theory, relations and functions, induction and recursion, symbolic logic, complex models, and application case studies.

**COMP-685. Advanced Analysis of Algorithms****Credit 3 (3-0)**

This course discusses the design and analysis of efficient algorithms and algorithmic paradigms. Applications include sorting, searching dynamic structures, graph algorithms, computationally hard problems, and NP completeness.

**COMP-696. Information, Privacy and Security****Credit 3 (3-0)**

This course examines the security and privacy issues associated with information systems. There are cost/risk tradeoffs to be made. Discussed are topics such as technical, physical, and administrative methods of providing security, access control, identification, and authentication. Encryption is examined, including Data Encryption Standards (DES) and public key crypto-systems. Management considerations such as key protection and distribution, orange book requirements, and OSI data security standards are covered. Privacy legislation is covered, as is current cryptographic research.

**GRADUATE STUDENTS ONLY****COMP-710. Software Specification, Analysis & Design****Credit 3 (3-0)**

This course examines the formalization of software requirements and the analysis of the flow of data through a proposed large software system. Methodologies covered include Structured Analysis (data flow diagramming), hierarchy charts, entity-relationship data diagrams, procedure specifications, and Information Engineering. Additional methodologies addressed include Jackson Structured Diagrams, Harlan Black Boxes, and Object-Oriented Analysis techniques. Prerequisite: Graduate standing.

**COMP-711. Software System Design, Implementation,  
Verification Validation****Credit 3 (3-0)**

This course proceeds from the evaluation of a completed system design for completeness, correctness, information engineering, and functionality. Accepted industry and academic standards for such reviews will be used, for example leveling of data flow diagrams, measures of module cohesion, control structures, and function point estimation. As part of the implementation process, verification and validation methodologies will be studied and practiced. An actual system will be implemented by the end of the semester. Prerequisite: COMP-710.

**COMP-712. Software Project Management****Credit 3 (3-0)**

This course examines the nature of data processing projects, definitions of purpose, scope, objectives, deliverable dates, and quality standards. Interpersonal interaction and people oriented management techniques are studied, along with team member measurement and assessment methods. Project management tools such as PERT (Project Evaluation and Review Technique), and CPM (Critical Path Method) are covered. Managerial styles in motivating, inno-

vating, and organizing will be examined, along with techniques for improving these skills. Equipment and software selection and installation guidelines, and the proper use of outside consulting services will be examined. Prerequisite: Graduate standing.

### **COMP-713. Social Impacts of Software Systems**

**Credit 3 (3-0)**

This course examines the increasing importance of computer technology in the functionality of our economy, our government, and our industry. Potential impacts upon personal privacy and autonomy are examined in relation to the public policy and social impacts of computer technology. The role and opportunity for historically under-represented technical professionals will be explored. Interdisciplinary readings, written and oral presentations, and in class debates are required. Outside speakers from related disciplines are invited to participate. Prerequisite: Graduate standing.

### **COMP-714. CASE, Automated Development and Information Engineering**

**Credit 3 (3-0)**

Beginning with the concepts of automated development, various models are reviewed in detail, especially Information Engineering, Methodology assessment approaches are covered, especially the Software Engineering Institute Process Maturity model, and a variety of organizational impacts of technology are examined. Computer Aided Software Engineering (CASE) is covered through tutorial laboratory sessions and a problem assignment. Topics include fundamentals of data analysis, diagramming tools for data modeling process analysis, presentation architecture, communications architecture, data architecture, process architecture, and application construction. Techniques and tools for defining menu structures, screens and screen dialogues, and user interface management systems are studied, as are the general principles of physical design. Prerequisite: Graduate standing.

### **COMP-715. Decision Support System**

**Credit 3 (3-0)**

This course examines methods of inference under uncertainty and problem solving strategies as key components of decision support systems. Knowledge based systems, knowledge acquisition and representation, and the planning, design and implementation of computer assisted decision systems are covered. The interactive use of software for management decision making is examined through examples drawn from decision modeling, simulations, and large-scale commercial applications. Prerequisite: Graduate standing.

### **COMP-717. Software Fault Tolerance**

**Credit 3 (3-0)**

The principles, techniques and current practices in the area of fault tolerant computing with an emphasis on system structure and dependability are examined in this course. Major topics include system models, software/hardware interaction, failure and reliability, fault tolerance principles, redundancy, rollback and recovery strategies, and N-version programming. Redundancy in data structures and the validation of fault tolerant software are studied. Prerequisite: Graduate standing.

### **COMP-718. Object Oriented Software Engineering**

**Credit 3 (3-0)**

This course covers the concept of the "object-oriented life cycle", demonstrating a practical methodology for the application of object oriented methods to large projects. The specific problems and solutions for large software systems are discussed. Object Oriented Requirements Analysis (OORA), Object-Oriented Requirements Specification (OORS), Object Oriented Analysis (OOA), Object Oriented Design (OOD), and Object Oriented Domain Analysis (OODA) are covered. Existing and upcoming object oriented Computer Aided Software Engineering (CASE) tools are examined and object oriented database design issues are discussed with analysis of specific systems currently in practice or under development. Prerequisite: Graduate standing.

**COMP-719. Software Reuse Techniques****Credit 3 (3-0)**

This course examines the state-of-the-art in software reuse techniques and systems, along with fundamental principles and models, and directions and problems for further research. The technological framework of software reuse is discussed along with reusability frameworks, assessment, and the operational problems of reusability. Major topics include a study of composition-based systems, classifications of reusable models, interface issues, information hiding for reuse, and the principles of parameterized programming. An approach using structured algebraic specification, partially interpreted schemes, and the templates approach to software reuse is presented, along with generation based systems, language based systems, application generators, and transformation-based systems. Prerequisite: Graduate standing.

**COMP-740. Advanced Artificial Intelligence****Credit 3 (3-0)**

This course is a further study of artificial intelligence principles, with a focus on knowledge-based systems. The course examines planning, belief revision, control, and system evaluation and implementation. Advanced topics include automated theorem proving, learning and robotics, neural nets, and the adequacy of existing theoretical treatments. Prerequisite: COMP-645.

**COMP-741. Knowledge Representation and Acquisition****Credit 3 (3-0)**

The representation formalisms used in artificial intelligence are explained, along with representation selection and implementation in common Artificial Intelligence languages and shells. Formalisms include first order logic and its extensions, semantic nets, frames and scripts, and KL-ONE-like languages. Knowledge acquisition is introduced as eliciting knowledge, interpreting elicited data within a conceptual framework, and the formalizing of conceptualizations prior to software implementation. Knowledge acquisition techniques such as protocol analysis, repertory grids, and laddering are examined. Prerequisite: Graduate standing.

**COMP-742. Automated Reasoning****Credit 3 (3-0)**

This course studies the computational aspects of logic via propositional and predicate calculi, as well as the theory underlying their automation through logic programming languages. Various forms of resolution and their soundness and completeness are examined along with unification and its properties. Proof procedures and their search characteristics, term rewriting, and techniques such as narrowing are researched as a means of theory resolution. The relationship of formal specification techniques such as cut elimination, efficiency, and implementation issues are addressed. Prerequisite: COMP-645.

**COMP-745. Computational Linguistics****Credit 3 (3-0)**

A presentation of computational linguistics theory and practice. Advanced readings that emphasize theories of dialogue and research methodologies are examined. Technical writing for journals and conferences is stressed as a goal of research output. Prerequisite: COMP-645.

**COMP-747. Computer Vision Methodologies****Credit 3 (3-0)**

This course researches techniques for image understanding, both low-level and high-level image processing, mathematical morphology, neighborhood operators, labeling and segmentation. Vision methods covered include perspective transformation, motion, the consistent-labeling problem, matching, object models, and knowledge-based vision. Prerequisite: COMP-645.

**COMP-749. Intelligent Robots****Credit 3 (3-0)**

This course examines intelligent robot systems as inclusive of knowledge representations, path finders, inference systems of rules and logic, and image understanding and spatial reasoning systems. Problems of navigation, algorithm development, robot programming languages and multiple robot co-operation are explored. Prerequisite: Graduate standing.



**COMP-750. Distributed Systems****Credit 3 (3-0)**

This course examines the operating system concepts necessary for the design and effective use of networked computer systems. Such concepts include communication models and standards, remote procedure calls, name resolution, distributed file systems, security, mutual exclusion, and distributed databases. Students are required to construct an advanced implementation of distributed operating system facilities or a simulation of same. Prerequisite: COMP-650.

**COMP-753. Performance Modeling and Evaluation****Credit 3 (3-0)**

Common techniques and current results in the performance evaluation of computer systems are studied in this course. Background material in probability theory, queuing theory, simulation, and discrete mathematics is reviewed so that a performance evaluation of resource management algorithms for operating systems and database management systems in parallel and distributed environments may be developed. Prerequisite: COMP-650.

**COMP-767. Computer Network Architecture****Credit 3 (3-0)**

This is a course in the architecture of computer communication networks and the hardware and software required to implement the protocols that define the architecture. Basic communication theory, transmission technology, private and common carrier facilities, international standards, satellite communications, and local area networks are examined. Methods of performance analysis and communication network modeling are discussed.

**COMP-780. Semantics of Programming Languages****Credit 3 (3-0)**

This course examines the formal treatment of the specification, meaning, and correctness of programs. Required mathematical results are examined, in areas such as universal algebra and category theory. Major course topics include the lambda calculus, type systems for programming languages, polymorphism, algebraic specification, rewrite systems, and semantic domains. The denotational semantics of programming languages, program logics, and program verification are discussed. Prerequisite: Graduate standing.

**COMP-790. Special Topics in Computer Science****Credit 3 (3-0)**

This course permits research in advanced topics pertinent to the student's program of study. Prerequisite: Permission of advisor.

**COMP-792. Computer Science Masters Seminar****Credit 1 (1-0)**

Discussions and reports of subjects in computer science and allied fields will be presented. Prerequisite: Graduate standing.

**COMP-793. Masters Supervised Teaching****Credit 3 (3-0)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Graduate standing.

**COMP-796. Masters Project****Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project and the deliverables, must be submitted for approval. This course is only available to project option students. Prerequisite: Graduate standing.

**COMP-797. Masters Thesis****Credit 3 (3-0)**

Master of science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the master's thesis. This course is only available to thesis option students. Prerequisite: Permission of advisor.



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## Curriculum and Instruction

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### OBJECTIVES

The Department of Curriculum and Instruction provides the professional studies component for the preparation of effective teachers and school personnel at the bachelor's degree and master's degree levels. The department cooperates with the various academic departments of the University for teacher education preparation. In addition, the department offers licensure and graduate degrees in the areas of elementary education, special education and instructional technology. Licensure only is available in special education.

### PROFESSIONAL STUDIES COMPONENT

The professional studies component of the Teacher Education Program is designed to provide for the development of those competencies essential to the professional role of a teacher or special service personnel. At the graduate level, approximately 20 to 40 percent of the graduate program is comprised of professional studies. Candidates for the degree in teacher education must complete a minimum of 15 semester hours in professional studies.

### ACCREDITATION

All Teacher Education Programs are accredited by the National Council for Accreditation of Teacher Education (NCATE) and approved by the North Carolina Department of Public Instruction.

### CAREER OPPORTUNITIES

In addition to preparing teachers for elementary education (K-6) and special education, a degree or licensure in these fields also provides for career opportunities in other areas related to the education of children and youth.

The instructional technology program has four program concentration areas that prepare students for different career paths. Students may prepare for a variety of positions in business and industry or obtain North Carolina licensure in one of the areas. Individuals who currently hold a North Carolina "A" teaching license may pursue coursework that prepares them for licensure as school media coordinators (076 licensure), instructional technologists-computers (077 licensure), or instructional technologists-telecommunications (074 licensure).

### DEGREES OFFERED

Elementary Education - MAEd  
Instructional Technology - Master of Science

### GENERAL PROGRAM REQUIREMENTS

Degree seeking students must follow the general admission requirements for graduate studies and meet other requirements as stated in "Admission and Other Information".

## THE ELEMENTARY EDUCATION GRADUATE PROGRAM

The Elementary Education Graduate Program provides advanced studies in the field of elementary education commensurate with INTASC, NCATE, SDPI, and National Board Certification Standards. The program provides experiences in research, technology, methodology, diversity, and learning theory. The program also requires a product of learning which includes a final comprehensive examination, a basic portfolio, and either a research project or a comprehensive portfolio that meets the requirements for submission for National Board Certification.

### Licensure Only Students

Candidates who are admitted to graduate studies as licensure only students can not be admitted to the Graduate Program until Class A licensure in elementary education is obtained. After a student obtains a Class A Certification, application for admission to the graduate program can be pursued.

### Admission Criteria

Other criteria for admission are GRE or MAT scores, and an undergraduate GPA of 2.5 or better. It is the responsibility of the candidate to meet these requirements as well as any other requirements of the School of Graduate Studies.

### Course Requirements

The Curriculum Guide outlines the sequence of required courses and the benchmarks. A copy of this guide will be kept in the student's folder in the advisor's office to be updated at each advising conference. Advising conferences must be arranged by the candidate prior to registration for the next semester. Before a candidate can register for classes in Phase 2 of the Elementary Education Graduate Program, all requirements of Benchmark I must have been met. Before a candidate can register for classes in Phase 3 of the Elementary Education Graduate Program, all requirements of Benchmark 2 must have been met.

### Products of Learning

All students will produce products of learning that include a passing grade on a comprehensive examination at Benchmark I upon completion of Phase I of the Elementary Education Graduate Program, a basic portfolio that meets the requirements of the North Carolina State Department of Public Instruction's performance based licensure, and completion of the Capstone Experience. The Capstone Experience requires a passing grade on the final comprehensive examination and either a research project or a comprehensive portfolio that meets the requirements for submission for National Board Certification in Elementary Education.

### PHASE I: DEVELOPING PERSPECTIVES. (Complete before beginning Phase 2.)

#### Requirements (15 hours)

CUIN 711: Research and Inquiry

CUIN 619: Learning Theories

CUIN 728: Integrating Technology into the K-12 Curriculum

CUIN 729: Diversity Issues in K-12 Schools

CUIN 721: Advanced Methods and Internship

Documentation of Approvals: (1) Planning contract; (2) Initial plan for Master's Research Project or Comprehensive Portfolio approved; (3) Core Comprehensive Examination passed.

## **PHASE II: CONTENT AND PEDAGOGY. (Complete before beginning Phase 3.)**

### **Requirements (24 hours)**

CUIN 768: Teaching and Learning in a Multicultural Classroom

CUIN 751: Advanced Communications

CUIN 752: Advanced Science

CUIN 754: Advanced Mathematics

CUIN 781: Advanced Social Studies

CUIN 785: Teachers as Educational Leaders

CUIN 786: Assessment and Evaluation

CUIN 720: Curriculum Development

Documentation of Approvals: (1) Master's Research Project Proposal or Four Entries in Comprehensive Portfolio

## **PHASE 3: CAPSTONE EXPERIENCE**

### **Requirements (1 hour)**

CUIN 999: Capstone Experience

Documentation of Approvals: (1) Comprehensive Examination passed, and (2) Completion of Research Project or Completion of Comprehensive Portfolio

## **INSTRUCTIONAL TECHNOLOGY**

The Master of Science degree program in Instructional Technology at North Carolina A & T State University is housed in the School of Education's Department of Curriculum and Instruction. This program helps students in both business and education to acquire skills and knowledge to work with instructional design and delivery at any level. A variety of coursework is offered to address different professional goals and needs within the field of Instructional Technology. All instructional technology program concentrations require a minimum of a 3.0 GPA for graduation.

Specifically, the coursework includes not only the use of a variety of media but the science and art of instructional planning, and the delivery of instruction in a variety of settings. Students will gain both theoretical and practical knowledge in the field of Instructional Technology. There are four Program Concentrations: business and industry and three add-on licensure areas.

**Accreditation:** All programs involving licensure are accredited by the National Council for Accreditation of Teacher Education (NCATE) and the North Carolina Department of Public Instruction. See student resources.

### **On-line Program**

North Carolina A&T State University offers the Business and Industry track of the Instructional Technology Master's program via the World Wide Web. Please consult the Center for Distance Learning Website ([www.distance.ncat.edu](http://www.distance.ncat.edu)) for further information.

## **Instructional Technology Specialist-Telecommunications (074) Program Concentration**

### **Core Requirements to be completed before Content and Pedagogy Courses (18 hours)**

CUIN 711: Research and Inquiry  
CUIN 619: Learning Theories  
CUIN 742: Instructional Design  
CUIN 728: Integrating Technology Across the Curriculum  
CUIN 729: Diversity

CUIN 721: Advanced Methods and Internship

Benchmark #1 - Core Comprehensive Exam

### **Required Content and Pedagogy (21 hours)**

CUIN 743: Foundations of Instructional Technology  
CUIN 616: Visual Media  
CUIN 762: Advanced Internet Uses in Education  
CUIN 709: Administration and Supervision  
CUIN 766: Distance Education  
CUIN 763: Multimedia Development and Evaluation  
CUIN 719: Internship in Instructional Technology

### **Elective Courses - None**

Benchmark #2 - Portfolio

Benchmark #3 - Capstone: Thesis or Special Project

## **Media Coordinator Program Concentration (076)**

### **Core Requirements to be completed before Content and Pedagogy Courses (18 hours)**

CUIN 711: Research and Inquiry  
CUIN 619: Learning Theories  
CUIN 742: Instructional Design  
CUIN 728: Integrating Technology Across the Curriculum  
CUIN 729: Diversity

CUIN 721: Advanced Methods and Internship

Benchmark #1: Core Comprehensive Exam

### **Required Content and Pedagogy (18 hours)**

CUIN 750: Cataloging and Media Material  
CUIN 613: Developmental Media for Children OR  
CUIN 614: Book Selection and Related Materials for Young People  
CUIN 616: Visual Media  
CUIN 716: Media Center Management  
CUIN 719: Internship in Instructional Technology

### **Elective Courses (9 hours)**

Benchmark #2: Portfolio and Praxis Examination (Library Media Specialist)

Benchmark #3: Capstone: Thesis or Special Project



## **Instructional Technology Specialist- Computers Program Concentration (077)**

### **Core Requirements to be completed before Content and Pedagogy Courses (18 hours)**

CUIN 711: Research and Inquiry

CUIN 619: Learning Theories

CUIN 742: Instructional Design

CUIN 728: Integrating Technology Across the Curriculum

CUIN 729: Diversity

CUIN 721: Advanced Methods and Internship

Benchmark #1: Core Comprehensive Exam

### **Required Content and Pedagogy (18 hours)**

CUIN 743: Foundations of Instructional Technology

CUIN 760: Programming in BASIC or

CUIN 761: Programming in LOGO

CUIN 762: Advanced Internet Uses in Education

CUIN 763: Multimedia Development and Evaluation

CUIN 767: Computer Lab Supervision and Management

CUIN 719: Internship in Instructional Technology

### **Elective Courses (3 hours)**

Benchmark #2: Portfolio

Benchmark #3: Capstone - Thesis or Special Project

## **Business and Industry Program Concentration**

### **Core Requirements to be completed before Content and Pedagogy Courses (18 hours)**

CUIN 711: Research and Inquiry

CUIN 619: Learning Theories

CUIN 742: Instructional Design

CUIN 743: Foundations of Instructional Technology

CUIN 741: Instructional Technology Services for Business and Industry

ADED 708: Methods in Adult Education

Benchmark #1: Core Comprehensive Exam

### **Required Content and Pedagogy (12 hours)**

CUIN 762: Advanced Internet Uses in Education

CUIN 763: Multimedia Development and Evaluation

TECH 670: Introduction to Workplace Training and Development

CUIN 719: Internship in Instructional Technology

### **Elective Courses (9 hours)**

(You may take approved courses from ADED, TECH or GCT).

Benchmark #2: Portfolio

Benchmark #3: Capstone: Thesis or Special Project

## **CURRICULUM AND INSTRUCTION**

### **Advanced Undergraduate and Graduate**

Six-hundred (600) level courses are considered upper level undergraduate and lower level graduate courses. These courses in the department are designed for post baccalaureate students pursuing licensure.

Students admitted to a graduate program will not be allowed to take more than six hours of 600 level courses without the approval of his/her advisor.

#### **CUIN-600. Cataloging of Media Materials**

**Credit 3 (3-0)**

This course offers a survey of various media classifications, storage and retrieval models as applied to information centers and their operation. Students will be taught to catalog media by using both traditional and technological methods. (F, S, S)

#### **CUIN-611. Utilization of Education Media**

**Credit 3 (2-2)**

##### **(Formerly Education Media 602)**

Applies basic concept to problems in teaching and learning with school and adult audiences. Relates philosophical and psychological bases of communications to teaching. Discusses the role of communications in problem solving, attitude formation, and teaching. Methods of selecting and using educational media materials effectively in teaching. Experience in operating equipment, basic techniques in media preparation. Practice in planning and presenting a session. (F, S, S)

#### **CUIN-613. Developmental Media for Children**

**Credit 3 (3-0)**

This course will entail a study of children's literature with emphasis on aids and criteria for selection of books and other materials for preschool through late childhood ages, story-telling, and an investigation of reading interests. (F, S, S)

#### **CUIN-614. Book Selection and Related Materials for Young People**

**Credit 3 (3-0)**

A consideration of literature, reading interests, and non-book materials for young people. (F, S, S)

#### **CUIN-616. Visual Media**

**Credit 3 (3-0)**

This course provides students with general visual design criteria and the application of those criteria to a variety of visual media forms. Students will create and evaluate a variety of visual media, such as non-projected forms, projected forms, video, and computer visuals. New forms of visuals may be included as they are developed. Prerequisite: CUIN 611. (F, S, S)

#### **CUIN-617. Computers in Education**

**Credit 3 (2-2)**

The student will be introduced to the various uses and functions of the computer in educational settings. The integration of the computer as a tool for instructor and student use; and as a tutor for student use in a variety of formats will be addressed. A basic introduction to the Internet and the World Wide Web will also be provided. Students will also explore different hardware and software configurations. This is not a course for introducing computer usage. (F, S, S)

#### **CUIN-619. Learning Theories**

**Credit 3 (3-0)**

This course examines behavioral, cognitive, and constructivist learning theory families and how they impact instructional methods and technology. The course will include writing instructional units based upon a variety of theoretical approaches. (F, S, S)

**CUIN-620. Foundations in Reading** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 630)**

Basic reading course; consideration of the broad field of reading - its goal and nature; factors affecting its growth; sequential development of skills, attitudes and interests, types of reading approaches, organization and materials in teaching the fundamentals of reading. (F, S, S)

**CUIN-621. Word Recognition/Identification Skills** **Credit 3 (3-0)**  
**(Former Elementary Education and Reading 631)**

This course explores phonic (letter-sound correspondence), syntactic (grammar), semantic (meaning), morphemic (structure) and visual word identification techniques for word recognition in developmental, corrective and remedial reading programs. Methods of teaching and materials for introducing and reinforcing the skills are included. (F, S, S)

**CUIN-622. Teaching Reading Through the Primary Years** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 635)**

Methods, materials, and techniques used in reading instructions of pre-school through grade three. An examination of learning, the teaching of reading, and curriculum experiences and procedures for developing reading skills. (F, S, S)

**CUIN-623. Methods and Materials in Teaching Reading in the**  
**Elementary School** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 636)**

The application of principles of learning and child development to the teaching of reading and the related language arts. Methods and approaches to the teaching of reading in the elementary school, including phonics, developmental measures, informal testing procedures, and the construction and utilization of instructional materials. (F, S, S)

**CUIN-624. Teaching Reading in the Secondary School** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 637)**

Nature of a developmental reading program, initiating and organizing a high school reading program, the reading curriculum, including reading in the content subjects, critical reading, procedures and techniques, and corrective and remedial aspects. (F, S, S)

**CUIN-625. Theory of American Public Education** **Credit 3 (3-0)**

An examination of the philosophical resources, objectives, historical influences, social organization, administration, support, and control of public education in the United States. (F, S, S)

**CUIN-627. The Afro-American Experience in American**  
**Education** **Credit 3 (3-0)**

Lectures, discussions, and research in the Afro-American in American education, including the struggle for literacy, contributions of Afro-Americans to theory, philosophy, and practice of education in the public schools, private and higher education. Traces the development of school desegregation, its problems and plans. (F, S, S)

**CUIN-628. Seminar and Practicum in Urban Education** **Credit 3 (1-4)**

A synthesis of practical experiences, ideas and issues pertinent to more effective teaching in urban areas. (F, S, S)

**CUIN-629. Classroom Diagnosis in Reading Instruction** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 638)**

Methods, techniques and materials, used in the diagnosis of reading problems in the kindergarten-primary area through the intermediate level. Attention upon the pupil and the interpretation of physiological, psychological, sociological, and educational factors affecting learning

to read. Opportunity for identification, analysis, interpretation of, and strategies for fulfilling the reading needs of all pupils. (F, S, S)

**CUIN-630. Reading Practicum**

**Credit 3 (3-0)**

**(Formerly Elementary Education and Reading 639)**

Application of methods, materials and professional practices relevant to teaching pupils. Provisions for participation in and teaching of reading. Designed to coordinate the student's background in reading, diagnosis, learning and materials. Supervised student teaching. Prerequisite: 12 credit hours in reading. (F, S, S)

**CUIN-631. Reading for the Atypical Learner**

**Credit 3 (3-0)**

**(Formerly Elementary Education and Reading 640)**

Attention to the gifted child, the able retarded, the slow learner, the disadvantaged, and the linguistically different child. Special interest groups will be formed for investigation reports. (F, S, S)

**CUIN-632. Basic Technology Literacy for K-12 Educators**

**Credit 3 (3-0)**

This course provides instruction in basic computer literacy skills and classroom integration for K-12 educators. The instruction is designed to meet the North Carolina Department of Public Instruction's requirements for basic level computer competencies for public school teachers. Topics include: word processing, spreadsheet usage, database design and management, teacher utilities, and fundamentals of modern computing. (F, S, S)

**CUIN-681. Issues in Education**

**Credit 3 (3-0)**

A critical review of the background and functions of the school as a social institution. (F, S, S)

*Graduate Students Only*

**CUIN-700. Introduction to Graduate Study**

**Credit 2 (2-0)**

Methods of research, interpretation of printed research data, and use of bibliographical tools. (F, S, S)

**CUIN-701. Philosophy of Education**

**Credit 3 (3-0)**

A critical study of and a philosophic approach to educational problems. The nature and aims of education in a democratic society, relation of the individual to society, interests and disciplines, play and work freedom and control, subject matter and method. (F, S, S)

**CUIN-709. Administration and Supervision**

**Credit 3 (3-0)**

This comprehensive course in organization and administration of schools, grades K-12, will focus primary emphasis on the following areas: (1) formal and informal organizational structure, concepts and practices; (2) the management processes; (3) the administrative functions, with particular reference to personnel, program, and fiscal management; and (4) leadership styles and the leadership role, with special attention to planning, decision-making, and conflict-resolution. Prerequisite: CUIN-704. (F, S, S)

**CUIN-710. Educational Statistics**

**Credit 3 (3-0)**

The essential vocabulary, concepts, and techniques of descriptive statistics as apply to problems in education and psychology. (F, S, S)

**CUIN-711. Research and Inquiry**

**Credit 3 (3-0)**

This course is designed to teach students to be able to locate, read, understand, critique, and use the results of research to become more effective professionals and make sound educational decisions. Students will develop an understanding of the researcher's methodologies, the procedures, and results. Students will analyze and evaluate research, judge the usefulness of the findings for educational practice, and plan research to improve educational practice. (F, S, S)



**CUIN-716. Media Center Management****Credit 3 (3-0)**

In this course students will be expected to explore different methods for organizing and operating media centers. Students will be expected to create plans for media center organization and operation, including budget planning. In addition, students will create plans for both student activities and faculty in-service as related to media center use. (F, S, S)

**CUIN-719. Internship in Instructional Technology****Credit 3 (1-4)**

This is a professional laboratory designed to provide the student with on-the-job training and direct experiences relating to his/her needs. Each student will be placed according to the professional track he/she has chosen within the program. Students will have an opportunity to develop research or special projects in an area related to practical experience. (F, S, S)

**CUIN-720. Curriculum Development****Credit 3 (3-0)**

This course will focus on basic concepts in curriculum development in K-12 schools. Prerequisites: Completion of Phase I of the M.S. Degree in Elementary Education or permission of the instructor. (F, S, S)

**CUIN-721. Advanced Methods and Internship****Credit 3 (3-0)****(Formerly Elementary Education and Reading 721)**

This course will focus on using an understanding of child development, diversity issues, motivational strategies to plan interdisciplinary units of instruction and assessments. Candidates will create learning experiences and to design a variety of modes of assessment, and to implement these plans. Internship is required. Prerequisites: Admission to the School of Graduate Studies. (F, S, S)

**CUIN-722. Curriculum in the Secondary School****Credit 3 (3-0)**

Curriculum development, functions of the secondary school, types of curricula; emphasis on trends, issues, and innovations. (F, S, S)

**CUIN-723. Principles of Teaching****Credit 3 (3-0)**

A study of the status of teaching as a profession in the United States; teacher obligations, responsibilities and opportunities for leadership in the classroom and community with special emphasis on principles of and procedures in teaching. (F, S, S)

**CUIN-724. Problems and Trends in Teaching Science****Credit 3 (3-0)**

Attention to major problems of the high school teacher of science. Lesson plans, assignments, test, etc., constructed and administered by each student in class. Audiovisual materials, demonstration and laboratory techniques carried out. (F, S, S)

**CUIN-725. Problems and Trends in Teaching Social Sciences****Credit 3 (3-0)**

Survey of major problems in the broad field of social studies and consideration of improved ways in presentation and class economy, including lesson plans, assignments, audiovisual materials, and other means of facilitating learning. (F, S, S)

**CUIN-726. Reading in the Content Areas****Credit 3 (3-0)**

Attention on reading problems and procedures and materials for improving reading in the social studies, science, English, mathematics, foreign language, home economics, and other fields. (F, S, S)

**CUIN-727. Workshop in Methods of Teaching Modern Mathematics for****Junior and Senior High School Teachers****Credit 3 (3-0)**

Model lesson plans, use of educational media, geometric and trigonometric devices, Truth Tables, and intuitive and formal logic in the teaching of modern mathematics in the junior and senior high school. (F, S, S)

**CUIN-728. Integrating Technology into the K-12 Curriculum** **Credit 3 (3-0)**

This course is designed to introduce teachers to the current and emerging technologies which can be incorporated into the K-12 curriculum. Prerequisite: Pass a Computer Competency Exam or CUIN 617. (F, S, S)

**CUIN-729. Diversity Issues in K-12 Schools** **Credit 3 (3-0)**

This course is designed to examine issues of diversity including economic, gender, ethnic, cultural, political, physical and cognitive diversities, and how they impact classroom practices. (F, S, S)

**CUIN-730. Problems in the Improvement of Reading** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 740)**

Study of current problems, issues, trends, and approaches in the teaching of reading including investigations of underlying principles of reading improvement; coverage of appraisal techniques, materials and procedures, innovative and corrective measures; and application of research data and literature. Prerequisite: A previous graduate course in reading. (F, S, S)

**CUIN-731. Advanced Diagnosis in Reading Instruction** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 741)**

The diagnosis and treatment of reading difficulties. Study and interpretation of selected tests useful in understanding and analyzing physiological, psychological, sociological and educational factors related to reading difficulties. Case studies and group diagnosis. (F, S, S)

**CUIN-732. Organization and Administration of Reading** **Credit 3 (3-0)**  
**Program**

**(Formerly Elementary Education and Reading 742)**

Administrative acts requisite to the creation and guidance of a well-balanced, school-wide reading program. For all school personnel who are in a position to make administrative decisions regarding the school reading program. (F, S, S)

**CUIN-733. Advanced Practicum in Reading** **Credit 3 (3-0)**

**(Formerly Elementary Education and Reading 743)**

Actual experiences with youth and teachers in professional activities. (F, S, S)

**CUIN-734. Seminar and Research in Reading** **Credit 3 (3-0)**

**(Formerly Elementary Education and Reading 744)**

Evaluation of recent research concerning findings, approaches innovations, and organization of reading instruction. Selected topics for reports and research projects. Independent study of selected topics of experimentation. Prerequisite: 24 semester credit hours in graduate courses. (F, S, S)

**CUIN-742. Instructional Design** **Credit 3 (3-0)**

The course will address the design, systematic development, implementation, modification, and ultimate evaluation of instructional programs. This will be inclusive of a survey of current research, objectives, outcomes, analysis of concepts, design of instructional sequences, and assessment of student performance. Each student will develop and assess at least one instructional program. (F, S, S)

**CUIN-743. Foundations of Instructional Technology** **Credit 3 (3-0)**

This course provides an overview of the Instructional Technology field. Students will be introduced to some of the significant issues, areas, and practices in instructional technology. The history, current trends, and issues in instructional technology and their implications for education and training will be discussed during the course. This course also examines the instructional applications of microcomputers and telecommunications in classroom settings. Students

will be informed of job opportunities, professional associations, and literature of the profession. (F, S, S)

**CUIN-744. Program Evaluation** **Credit 3 (3-0)**

This course will provide students with the basic information needed to evaluate educational programs and make recommendations for program improvement. Prerequisite: CUIN 742. (F, S, S)

**CUIN-745. Instructional Technology Services for Business and Industry** **Credit 3 (3-0)**

This course introduces students to the impact of technology within business and industry and how learning in that environment warrants instruction that differs from that of traditional education. Students will have the opportunity to (a) investigate various learning and presentation needs of business and industry clients; and (b) apply different delivery methods and techniques, and technological applications to specific audiences in that environment. (F, S, S)

**CUIN-746. Social Foundations of Instructional Technology** **Credit 3 (3-0)**

This course will provide students with an opportunity to explore the philosophical, personal, and social issues underlying the universal acceptance of the technological revolution, with special emphasis on technology in education and in K-12 schools. (F, S, S)

**CUIN-747. Independent Study in Instructional Technology** **Variable Credit (1-3)**

Students will pursue individual project(s) and topic(s) of choice with the approval of the instructor. (F, S, S)

**CUIN-748. Special Topics in Instructional Technology** **Variable Credit (1-3)**

This course will permit the investigation and study of developing areas/topics of concern in the field of instructional technology. (F, S, S)

**CUIN-751. Advanced Communication Skills** **Credit 3 (3-0)**

This course will focus on approaches for teaching communications skills/language arts and children's literature in elementary school. Prerequisites: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

**CUIN-752. Advanced Science** **Credit 3 (3-0)**

This course will focus on approaches for teaching science in elementary school. Prerequisites: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

**CUIN-754. Advanced Mathematics** **Credit 3 (3-0)**

This course will focus on approaches for teaching mathematics in elementary school. Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)

**CUIN-760. Programming in BASIC** **Credit 3 (2-2)**

This course will provide students with an opportunity to learn program logic and structured programming for BASIC. Emphasis will be on the use of programming in the K-12 environment. Prerequisite: CUIN 617 or equivalent experience. (F, S, S)

**CUIN-761. Programming in LOGO** **Credit 3 (2-2)**

This course provides students with the opportunity to programming and logic and structured programming for LOGO. Emphasis will be on the use of programming in the K-12 environment. (F, S, S)

**CUIN-762. Advanced Internet Uses in Education****Credit 3 (2-2)**

This course explores use of the Internet for the purpose of enhancing instructional activities. Students will investigate a variety of resources on the Internet, which can be used for instructional purposes. Students will explore the World Wide Web and develop Web pages. Prerequisite: CUIN 617 or equivalent. (F, S, S)

**CUIN-763. Multimedia Development and Evaluation****Credit 3 (2-2)**

This course offers experiences in the evaluation and development of multimedia instructional presentations using computer-based multimedia capabilities. Theories and research in multimedia development will be discussed. Prerequisite: CUIN 617 or equivalent. (F, S, S)

**CUIN-764. Educational Software Evaluation and Design****Credit 3 (2-2)**

This course will provide students with the opportunity to apply instructional design techniques and learning theories to the evaluation and development of educational software. During the course students will learn storyboarding and use it as a means to create computer-based software. Some limited experiences with authoring software will be provided. Prerequisite: CUIN 742. (F, S, S)

**CUIN-765. Authoring Software****Credit 3 (2-2)**

Students will utilize authoring software to create educational software or develop presentations. Students will import graphics, sound, and video into the authoring program and write appropriate script routines to implement a variety of actions within the program. Knowledge and usage of authoring software will enable students to create complex multimedia presentations or complex tutorial educational software. Prerequisite: CUIN 617 or equivalent experience. (F, S, S)

**CUIN-766. Distance Education****Credit 3 (3-0)**

Students will learn about a variety of distance education delivery systems and methods. Different technological configurations will be addressed. Students will review the research on the effectiveness of varied distance delivery systems. (F, S, S)

**CUIN-767. Computer Lab Supervision and Management****Credit 3 (2-2)**

This course will provide students with an opportunity to explore different methods for supervising, managing, maintaining, organizing, and operating computer labs in schools. Prerequisite: CUIN 617 or equivalent experience. (F, S, S)

**CUIN-768. Teaching and Learning in a Multicultural Classroom****Credit 3 (3-0)**

This course will focus on the incorporation of multicultural issues in the elementary school curriculum. Prerequisite: Completion of Phase I of the MS Degree Program in Elementary Education or permission of the instructor. (F, S, S)

**CUIN-776. Independent Reading in Education II****Credit 3 (3-0)****(Formerly Elementary Education and Reading 786)**

Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)

**CUIN-777. Independent Reading in Education III****Credit 3 (3-0)****(Formerly Elementary Education and Reading 787)**

Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)

**CUIN-780. Comparative Education****Credit 3 (3-0)**

Historical and international factors influencing the development of national systems of education, recent changes in educational programs of various countries. (F, S, S)



- CUIN-781. Advanced Social Studies** **Credit 3 (3-0)**  
**(Formerly Elementary Education and Reading 781)**  
 This course will focus on approaches to the teaching of social studies in elementary school and the creation of a learning environment that will ensure that all students will learn fundamentals of social studies. Candidates will be required to conduct field research. (F, S, S)
- CUIN-782. Issues in Secondary Education** **Credit 3 (3-0)**  
 An analysis of the role of the high school as an educational agency in a democracy. Attention is given to: (1) philosophical, psychological, and sociological bases for the selection of learning experiences; (2) contrasting approaches to curriculum construction; (3) teaching methods and materials; (4) evaluation procedures; and (5) school-community relationships. (F, S, S)
- CUIN-783. Current Research in Elementary Education** **Credit 3 (3-0)**  
 A critical analysis of the current research in elementary education and the implications of such for elementary school educative experiences. (F, S, S)
- CUIN-784. Current Research in Secondary Education** **Credit 3 (3-0)**  
 A critical analysis of the current research in secondary education and the implications of such for high school educative experiences. (F, S, S)
- CUIN-785. Teachers as Educational Leaders** **Credit 3 (3-0)**  
 This course will focus on the attributes and dispositions of leadership for teachers. Action research is required. Prerequisite: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)
- CUIN-786. Assessment and Evaluation** **Credit 3 (3-0)**  
 This course will focus on multiple modes of assessment and evaluation in elementary school. Prerequisite: Completion of Phase I of the M.S. Degree Program in Elementary Education or permission of the instructor. (F, S, S)
- CUIN-S-787. Independent Readings in Education III** **Credit 3 (0-6)**  
 Individual study and selected reading in consultation with an instructor. Prerequisite: 24 hours of graduate credit. (F, S, S)
- CUIN-S-790. Seminar in Educational Problems** **Credit 3 (1-4)**  
 Intensive study, investigation, or research in selected areas of education; reports and constructive criticism. Prerequisites: A minimum of 24 hours in prescribed graduate courses. (F, S, S)
- CUIN-S-791. Thesis Research** (F, S, S) **Credit 3**
- CUIN-999. Thesis** (F, S, S) **Credit 1**

## SPECIAL EDUCATION

- SPED-660. Introduction to Exceptional Children** **Credit 3 (3-0)**  
 An overview of the educational needs of exceptional or "different" children in the regular classroom situation, emphasis placed on classroom techniques known to be most helpful to children having hearing losses, speech disorders, visual problems, emotional, social handicaps and intelligence deviation, including slow-learners and gifted children. An introduction to the area of special education. Designed for classroom teachers. (F, S, S)
- SPED-661. Psychology of the Exceptional Child** **Credit 3 (3-0)**  
 An analysis of psychological factors affecting identification and development of individuals with high and low incidence disabilities. (F, S, S)

**SPED-662. Mental Disability****Credit 3 (3-0)**

A survey of types and characteristics of individuals with mental disabilities; etiologies, diagnosis, classification and placement. (F, S, S)

**SPED-663. Measurement and Evaluation in Special Education** **Credit 3 (3-0)**

The selection, administration, and interpretation of individual tests; intensive study of problems in testing exceptional and extremely deviant children; consideration to measurement and evaluation of children who are mentally, physically, and emotionally or socially handicapped. Emphasis upon the selection and use of group tests of intelligence and the interpretation of their results. (F, S, S)

**SPED-664. Methods and Curriculum Programming for Children and Youth with Behavioral Disabilities****Credit 3 (3-0)**

Basic organization of programs for the education of the mentally retarded; classification and testing of mental defectives; curriculum development and principles of teaching intellectually slow children. Attention is also given to the provision of opportunities for observing and working with children who have been classified as mentally retarded. (F, S, S)

**SPED-665. Teaching Exceptional Strategies for Students in Inclusive Settings****Credit 3 (3-0)**

This course is designed for both the general and special educator working with special needs students in the inclusive classroom. Effective instructional strategies for diverse learners, consultation and collaborative problem solving techniques, and the cooperative teaching model will be explored. (DEMAND)

**SPED-667. Specific Learning Disabilities****Credit 3 (3-0)**

This course will address specific learning problems associated with reading, writing, language, cognition, perception attention, arithmetic, social, and emotional disabilities. (F, S, S)

**SPED-668. Children & Youth with Behavioral Disabilities****Credit 3 (3-0)**

A study of issues, definitions, classification, characteristics, causes and prevalence of children and youth with behavioral disorders. It will examine models, assessment and intervention strategies. (F, S, S)

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## Electrical Engineering

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jck@ncat.edu

### OBJECTIVE

The objective of graduate study in the Electrical Engineering Department is to provide an advanced level of study in the areas of: (i) computer engineering; (ii) power systems and controls; (iii) communication and signal processing; (iv) electronic and optical materials and devices. The Master of Science (M.S.) in Electrical Engineering program is designed to prepare graduates for doctoral level study or for advanced professional practice. The Doctor of Philosophy (Ph.D.) in Electrical Engineering provides instruction and independent research opportunities for students. The graduates of the MSEE and Ph.D. program in Electrical Engineering are well prepared for research oriented careers in industry, governmental laboratories, and in academia.

### DEGREES OFFERED

Electric Engineering - Master of Science  
Electrical Engineering - Doctor of Philosophy

### MASTER OF SCIENCE

#### *General Program Requirements:*

The admission of students to the graduate degree program in the Department of Electrical Engineering is based upon a baccalaureate degree in Electrical Engineering from an accredited institution. A grade point average of 3.0 out of 4.0 is required for unconditional admission to the Master of Science in Electrical Engineering program. Provisional admission may be granted to a candidate who possesses an accredited undergraduate degree in engineering or in a closely related discipline with an overall grade point of at least 2.8 out of 4.0, and has no background deficiencies requiring more than twelve semester hours at the undergraduate level. Graduate Record Examination scores for Master of Science Degree in Electrical Engineering are required for international applicants and are also used in making decisions regarding financial assistance.

#### *Degree Requirements:*

The Master Science in Electrical Engineering program consists of three options: (a) Thesis Option, (b) Project Option, and (c) Course Only Option. The Thesis Option requires a minimum of 24 hours of coursework, at least 1 hours of 792, and 6credit hours of master these 797. The Project Option requires a minimum of 30 hours of coursework, at least 1 hour of 792, and 3 hours of 796. The Course Only option requires 33 hours of coursework and at least 1 hour of 792. At least 12 credit hours for the thesis option and 15 credit hours for the project and course only options must be at or above the 700 level. A maximum of 6 hours of coursework can be taken outside the department subject to approval by the Advisory Committee.

## DOCTOR OF PHILOSOPHY

### *General Program Requirement:*

Satisfying the minimum requirements described below does not guarantee admission. Denial of admission does not necessarily imply a negative evaluation of an applicant's qualifications. Limited space and other facilities often force limits on the number of students in certain specialties. For details concerning admission requirements, see Admission and Other Information elsewhere in this catalog.

### *Degree Requirements:*

1. **Credit-Hour Requirements:** The Ph.D. program in Electrical Engineering is based on the Dissertation Option. This program requires 24 credit hours of coursework. At least 12 credit hours must be at the 800 level. A minimum of 12 credit hours of doctoral dissertation 997, 3 hours of 992 and 6 hours of 995 are required. No more than 6 credit hours at the graduate level in an area outside of electrical engineering will be accepted to satisfy a graduate area concentration. Thus, total 45 credit hours are required for the doctoral degree. The student should be encouraged to take all courses related to the subjects elected for his/her qualifying exam.
2. **Dissertation Research:** There is no limit to the maximum number of dissertation, research, or special topics credits for Ph.D. students, but no more than 12 dissertation credits will be counted toward the 45 credit hours requirement described above. These credits alone do not constitute sufficient work at the dissertation/research level.
3. **Advisory Committee:** Each student must form his or her advisory committee before or during the semester in which fifteen or more credits are completed toward the degree sought.
4. **Committee Membership:** All members of the student's advisory committee must be regular faculty members of the North Carolina Agricultural and Technical State University College of Engineering. They must also be eligible to work with graduate students in this College. Others may serve in an ex-officio capacity, and must be identified as such on the appointment form. A vita for ex-officio members must be attached to the appointment form. A student may submit a written request to change the membership of his or her advisory committee at any time. The request is subject to the approval of the committee chair, the department Graduate Coordinator, and the School of Graduate Studies.  
The advisory committee for a Ph.D. student consists of a chairperson, three other members from the Department of Electrical Engineering, and where appropriate, a representative from the selected concentration area outside the department. The chair must be selected from the Faculty of the Department of Electrical Engineering in the area of emphasis chosen by the student. A fifth member, the School of Graduate Studies representative, will be appointed by the School of Graduate Studies when the Plan of Work is approved. The School of Graduate Studies representative attends the preliminary and final oral examinations and must sign the reports of those examinations, but does not otherwise participate in directing the student's technical work. Ph.D. committees must contain five members.
5. **The Plan of Work:** Each graduate student must submit a Plan of Work (PW) to the Office of the Electrical Engineering Graduate Coordinator during the term in which the student will complete 15 or more credits toward the degree sought. If the 15 credits are expected to be completed at the end of a regular semester, the Plan of Work must be submitted one full week before the beginning of preregistration for the following semester. If the 15 credits will be completed at the end of a summer session, the Plan of Work must be submitted before registration day for the following semester. The Plan of Work shows committee



chairperson, other committee members, and a sequential list of courses approved by that student's advisor. Each member's signature on the Plan of Work denotes their approval of the plan of study. Upon approval by the Graduate School, this Plan becomes the student's official guide to completing his/her program, and the listed individuals form the official Ph.D. Advisory Committee.

6. **Submission of Theses and Dissertations:** Upon passing the Ph.D. final oral examination, each Ph.D. student must have the thesis or dissertation approved by each member of the student's advisory committee. The thesis or dissertation must be submitted to the School of Graduate Studies by the deadline given in the academic calendar, and must conform to the Guide For Preparation of Thesis and Dissertations, a copy of which may be obtained from the Electrical Engineering Graduate Office. Submission of Thesis and Dissertations to the School of Graduate Studies is by appointment only. Telephone numbers to be used for scheduling, and the location for turning in the thesis or dissertation, will be made available by the School of Graduate Studies.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

## OTHER INFORMATION

See "Requirements for the Doctor of Philosophy Degree" elsewhere in this catalog for information related to residence requirements, qualifying examination, preliminary examination, comprehensive examination, final oral examination, admission to candidacy, and time limit. Students should also consult the departmental handbook for more details.

## SUMMARY OF COURSE OFFERINGS

The 600 level courses numbered 600-699 are open to qualified seniors and graduate students for masters program. Courses numbered 700 and above are only open to graduate students.

COURSE #	DESCRIPTION	CREDIT
ELEN 602	Semiconductor Theory and Devices	3 (3-0)
ELEN 606	Digital Electronics	3 (3-0)
ELEN 608	Analog Electronics	3 (3-0)
ELEN 614	Integrated Circuit Fabrication Methods	3 (3-0)
ELEN 615	Silicon Device Fabrication Laboratory	2 (1-3)
ELEN 621	Embedded Systems Design	3 (3-0)
ELEN 622	Embedded Systems Design Laboratory	2 (1-3)
ELEN 623	Digital Systems	3 (3-0)
ELEN 624	Computer Organization and Architecture Design	3 (3-0)
ELEN 629	VLSI Circuit Design	3 (3-0)
ELEN 630	VLSI Design Laboratory	2 (1-3)
ELEN 647	Introduction to Telecommunication Networks	3 (3-0)
ELEN 650	Digital Signal Processing I	3 (3-0)
ELEN 651	Digital Signal Processing Laboratory	2 (1-3)
ELEN 656	Probability and Random Processes	3 (3-0)
ELEN 657	Image Processing	3 (3-0)
ELEN 661	Power Systems Analysis	3 (3-0)
ELEN 662	Advanced Power Systems Laboratory	2 (1-3)

ELEN 668	Automatic Control Theory	3 (3-0)
ELEN 669	Control Laboratory	2 (1-3)
ELEN 674	Genetic Algorithms	3 (3-0)
ELEN 678	Introduction to Artificial Neural Networks	3 (3-0)
ELEN 679	Machine Intelligence Laboratory	2 (1-3)
ELEN 685	Selected Topics in Engineering	3 (3-0)
ELEN 686	Special Projects	Var. (1-3)
ELEN 701	Electronic Ceramics	3 (3-0)
ELEN 710	Wave and Fields in Radio Frequency (RF) and Optoelectronics	3 (3-0)
ELEN 720	Theoretical Issue in Computer Engineering	3 (3-0)
ELEN 721	Fault-Tolerant Digital System Design	3 (3-0)
ELEN 723	System Design Using Programmable Logic Devices	3 (3-0)
ELEN 724	Mixed-Signal VLSI Design	3 (3-0)
ELEN 727	Switching and Finite Automata Theory	3 (3-0)
ELEN 749	Digital Communications	3 (3-0)
ELEN 752	Wireless Information Networks	3 (3-0)
ELEN 762	Network Matrices and Graphs	3 (3-0)
ELEN 764	Power System Planning	3 (3-0)
ELEN 785	Masters Special Topics	3 (3-0)
ELEN 792	Masters Seminar	1 (1-0)
ELEN 793	Masters Supervised Teaching	3 (0-3)
ELEN 794	Masters Supervised Research	3 (0-3)
ELEN 796	Masters Project	3 (3-0)
ELEN 797	Masters Thesis	Var. (3-6)
ELEN 801	Solid State Devices	3 (3-0)
ELEN 802	Advanced Solid State Theory	3 (3-0)
ELEN 803	Compound Semiconductor Materials and Devices	3 (3-0)
ELEN 804	Semiconductor Material and Device Characterization	3 (3-3)
ELEN 805	Thin Film Technology for Device Fabrication	3 (3-0)
ELEN 810	Theory and Techniques in Photonics	3 (3-0)
ELEN 821	Advanced Computer Organization and Architecture	3 (3-0)
ELEN 822	Error-Correcting Codes	3 (3-0)
ELEN 823	Advanced VLSI Design	3 (3-0)
ELEN 847	Telecommunication Networks	3 (3-0)
ELEN 848	Information Theory	3 (3-0)
ELEN 849	Data Communications	3 (3-0)
ELEN 850	Digital Signal Processing II	3 (3-0)
ELEN 857	Pattern Recognition	3 (3-0)
ELEN 861	Power System Control and Protection	3 (3-0)
ELEN 862	Computer Methods in Power Systems	3 (3-0)
ELEN 865	Theory of Linear Systems	3 (3-0)
ELEN 866	Discrete Time Systems	3 (3-0)
ELEN 867	Neural Networks Design	3 (3-0)
ELEN 868	Intelligent Methods for Control Systems	3 (3-0)
ELEN 869	Machine Vision for Intelligent-Robotics	3 (3-0)
ELEN 870	Fuzzy Logic with Applications	3 (3-0)
ELEN 871	Nonlinear Control Systems	3 (3-0)
ELEN 885	Doctoral Special Topics	3 (3-0)

ELEN 992	Doctoral Seminar	1 (0-1)
ELEN 993	Doctoral Supervised Teaching	3 (0-3)
ELEN 994	Doctoral Supervised Research	3 (0-3)
ELEN 995	Doctoral Preliminary Examination	3 (0-3)
ELEN 997	Doctoral Dissertation	Var. (3-12)

## DESCRIPTION OF GRADUATE COURSES

### Under the Master's and Doctoral Degree Programs in Electrical Engineering

#### **ELEN-602. Semiconductor Theory and Devices** **Credit 3 (3-0)**

This course is a study of the phenomena of solid-state conduction and devices using band models, excess carriers in semiconductors, p-n junctions, and devices. Prerequisite: ELEN-460 or consent of instructor.

#### **ELEN-606. Digital Electronics** **Credit 3 (3-0)**

This course covers analysis, design and applications of digital integrated circuits. These circuits may include resistor-transistor logic (RTL), diode transistor logic (DTL), transistor-transistor (TTL), emitter-coupled logic (ECL), metal-oxide-semiconductor (MOS) gates and n-channel MOS (NMOS) logic, complementary MOS (CMOS) logic, Bipolar CMOS (BiCMOS) structures, memory circuits, and interfacing circuits. Prerequisite: ELEN-460 or consent of instructor.

#### **ELEN-608. Analog Electronics** **Credit 3 (3-0)**

This course covers the analysis, design and application of analog integrated circuits. These circuits may include operational amplifiers, voltage comparators, voltage regulators, Integrated Circuit (IC) power amplifiers, Digital to Analog (D/A) and Analog to Digital (A/D) converters, voltage-controlled oscillators, phase-locked loops, other special-function integrated circuits. Prerequisite: ELEN-460 or consent of instructor.

#### **ELEN-614. Integrated Circuit Fabrication Methods** **Credit 3 (3-0)**

This course presents the various processes utilized in the fabrication of semiconductor integrated circuits. Oxidation, diffusion, ion implantation, metalization, and epitaxial processes will be discussed. Limits on device design and performance will be considered. Prerequisite: ELEN-470 or consent of instructor.

#### **ELEN-615. Silicon Device Fabrication Laboratory** **Credit 2 (1-3)**

Laboratory experiments in the fabrication of silicon p-n junction diodes, MOS capacitors and MOS field effect transistors will be performed. Oxidation, diffusion, photolithography, and metalization techniques will be presented. Corequisite: ELEN-614.

#### **ELEN-621. Embedded Systems Design** **Credit 3 (3-0)**

This course is a survey of modern methods for specifying algorithms, simulating systems, and mapping specifications onto embedded systems. It presents an introduction to the technologies used in the design and implementation of programmable embedded systems, such as programmable processors, cores, memories, dedicated and configurable hardware, software tools, schedulers, code generators, and system-level design tools. Prerequisite: ELEN-427 or consent of instructor.

#### **ELEN-622. Embedded Systems Design Laboratory** **Credit 2 (1-3)**

This laboratory course is an introduction to developing processor-based embedded systems. The development tools include a C++ cross compiler, an Electronically Programmable Read Only Memory (EPROM), and an Application Specific Integrated Circuit (ASIC) programmer. A student project is part of the laboratory requirements. Corequisite: ELEN-621.

**ELEN-623. Digital Systems****Credit 3 (3-0)**

Digital system top-down design and analysis will be presented. Topics include timing, power and performance issues in digital circuits, Very High Speed Integrated Circuit Hardware Description Language (VHDL)-based system analysis and synthesis, hardware-software co-design, data-flow models, and digital system primitives. Prerequisite: ELEN-427 or consent of instructor.

**ELEN-624. Computer Organization and Architecture Design****Credit 3 (3-0)**

This course covers the design of modern uniprocessors and their memory, and Input/Output (I/O) subsystems. Performance, microarchitecture, and design philosophies used to realize pipeline, superscalar, Reduced Instruction Set Computer (RISC) and Complete Instruction Set Computer (CISC) processors will be studied. Prerequisite: ELEN-427 or consent of instructor.

**ELEN-629. VLSI Circuit Design****Credit 3 (3-0)**

This course will study CMOS technology and device characteristics in order to develop layout design rules for VLSI circuit building blocks, such as inverters and logic gates. Layout techniques for complex gates and designing combinational and sequential logic circuits will be introduced. Prerequisite: ELEN-427 or consent of instructor.

**ELEN-630. VLSI Design Laboratory****Credit 2 (1-3)**

This is an introduction of Computer Aided Design (CAD) tools for integrated circuit design and verification. These CAD tools include; geometric pattern generators, design rule checkers, circuit simulators, and Programmable Logic Array (PLA) generators. A student design project is part of the laboratory requirements. Corequisite: ELEN-629.

**ELEN-647. Introduction to Telecommunication Networks****Credit 3 (3-0)**

This course introduces telecommunication networks utilization and design. Emphasis is on using and designing voice, video and image digital networks. Prerequisite: ELEN-400.

**ELEN-650. Digital Signal Processing I****Credit 3 (3-0)**

This course develops a working knowledge of the basic signal processing functions, such as digital filtering spectral analysis, and detection/post-detection processing. Methods of generating the coefficients for digital filters will be derived. Alternate structures for filters, such as infinite impulse response and finite impulse response will be compared. The effect of finite register length will be covered. Prerequisite: ELEN-400 or consent of instructor.

**ELEN-651. Digital Signal Processing Laboratory****Credit 2 (1-3)**

Experiments and student projects will be performed which are related to the practical applications of digital signal processing techniques to data acquisition, digital filtering, control, spectral analysis, and communications. Corequisite: ELEN-650.

**ELEN-656. Probability and Random Processes****Credit 3 (3-0)**

This course covers probability, random variables, random processes, Gaussian processes, probabilistic description of signals and noise, including joint, marginal and conditional densities, autocorrelation, cross-correlation and power spectral density; linear and nonlinear transformations; linear least-squares estimation, and signal detection. Prerequisite: ELEN-310 or consent of instructor.

**ELEN-657. Image Processing****Credit 3 (3-0)**

This course deals with concepts and techniques for digital image analysis and processing. Topics include image representation, image enhancement, edge extraction, image segmentation, geometric structure, feature extraction, knowledge representation, and image understanding. Prerequisite: ELEN-400 or consent of instructor.



**ELEN-661. Power Systems Analysis****Credit 3 (3-0)**

The course studies power system representation, transmission lines, symmetrical and asymmetrical faults, electric power flow, power systems control and stability. Prerequisite: ELEN-430.

**ELEN-662. Advanced Power Systems Laboratory****Credit 2 (1-3)**

In this laboratory course, basic concepts, transmission lines, power flows, faults, and transient and steady-state stability will be investigated. Prerequisite: ELEN-436 or consent of instructor. Corequisite: ELEN-661.

**ELEN-668. Automatic Control Theory****Credit 3 (3-0)**

This course introduces the theory of linear systems represented by state equations. Topics include Jordan canonical form, solutions to state equations, relationship to transfer functions, stability, controllability, and pole placement design. Prerequisite: ELEN-410 or consent of instructor.

**ELEN-669. Control Laboratory****Credit 2 (1-3)**

This laboratory course demonstrates methods of system identification and control. Verifications of control system designs in both the time domain and frequency domain will be studied. Corequisite: ELEN-661.

**ELEN-674. Genetic Algorithms****Credit 3 (3-0)**

This course covers the theory and application of genetic algorithms. Genetic algorithms combine a Darwinian survival-of-the-fittest with a randomized, yet structured, information exchange to form an improved search mechanism with surprising robustness. Engineering applications of genetic algorithms for design and control will be presented. Prerequisite: ELEN-410 or consent of instructor.

**ELEN-678. Introduction to Artificial Neural Networks****Credit 3 (3-0)**

This course introduces neural network design and development. Emphasis is on designing and implementing information processing systems that autonomously develop operational capabilities in adaptive response to an information environment. Prerequisite: ELEN-400 or consent of instructor.

**ELEN-679. Machine Intelligence Laboratory****Credit 2 (1-3)**

This laboratory will explore the design and development of intelligent, autonomous, physical agents. An emphasis will be placed upon machine intelligence experiments with visual sensors, tactile sensors, robotic manipulators and autonomous inexpensive mobile robots. Prerequisite: ELEN-433 or consent of instructor. Corequisite: ELEN-678.

**ELEN-685. Selected Topics in Engineering****Credit 3 (3-0)**

This lecture course is used to introduce engineering topics of current interest to students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: consent of instructor.

**ELEN-686. Special Projects****Var. Credit (1-3)**

This is an investigation of an engineering topic which is arranged between a student and a faculty advisor. Project topics may be analytical and/or experimental and should encourage independent study. Prerequisite: consent of instructor.

**ELEN-701. Electronic Ceramics****Credit 3 (3-0)**

This course introduces the properties of ceramic materials in electronic applications. The effects of processing parameters on the ultimate device characteristics will be investigated. Prerequisite: ELEN-602 or consent of instructor.

## **ELEN-710. Wave and Fields in Radio Frequency (RF) and**

### **Optoelectronics**

**Credit 3 (3-0)**

This course emphasizes principles, phenomena and methods relevant to RF and lightwave technology. The topics will include basic electromagnetic propagation in free space and material media, guided electromagnetic waves, modes and mode coupling, and Bragg and other types of scattering. This course will establish the field principles of RF, integrated optic and fiber based devices and circuits. Prerequisite: ELEN-450 or ELEN-470 or consent of instructor.

## **ELEN-720. Theoretical Issues in Computer Engineering**

**Credit 3 (3-0)**

This course is designed to introduce some basic theoretical aspects of computer engineering. It includes selected topics in the set theory, elements of algebra such as semigroups, monoids, groups, rings, and fields, quotient groups and homomorphism theorems. It also includes finite state machines, the Myhill-Nerode theory, pseudo/random generators, linear feed back registers, introduction to error correcting codes and Turing Machines. Various applications will be demonstrated. Prerequisite: ELEN-427 or consent of instructor.

## **ELEN-721. Fault-Tolerant Digital System Design**

**Credit 3 (3-0)**

This course covers reliability, test generation, self checking techniques, principles and applications of fault-tolerant design techniques. Prerequisite: ELEN-625 or consent of instructor.

## **ELEN-723. System Design Using Programmable Logic Devices**

**Credit 3 (3-0)**

This course will cover and compare many commercially available Programmable Logic Devices and consider their applications in both combinational and sequential logic system design. Students will also be familiarized with hardware description language such as VHDL and ABELTM and shown how design ideas can be efficiently translated into programmable hardware implementations. Prerequisite: ELEN-623 or consent of instructor.

## **ELEN-724. Mixed-Signal VLSI Design**

**Credit 3 (3-0)**

This course will introduce CMOS circuit techniques for low-power, low-voltage mixed-signal integrated circuits. Continuous-time signal processing, sampled-data analog filters, delta-sigma data converters, and mixed analog-digital layout techniques will be introduced. Prerequisite: ELEN-629 or consent of instructor.

## **ELEN-727. Switching and Finite Automata Theory**

**Credit 3 (3-0)**

This course presents the abstract mathematical modeling of combinational and sequential switching networks. Finite automata theory and fault tolerant concepts with applications to both combinational networks and finite state machines will be presented. Prerequisite: ELEN-427 or consent of instructor.

## **ELEN-749. Digital Communications**

**Credit 3 (3-0)**

The fundamental theory and applications of the digital communications system are discussed based on the knowledge of the probability theory. Topics in digital communications include sampling, quantizing, coding, detection, modulation/ demodulation, signal-to-noise ratio, and error probability. Prerequisite: ELEN-449 or consent of instructor.

## **ELEN-752. Wireless Information Networks**

**Credit 3 (3-0)**

Fundamental theory and applications of wireless mobile communication systems are covered for voice, data, and multimedia. Topics in wireless networks include characterization of radio propagation, source and channel coding, theory and analysis of wireless data networks, and wireless Local Area Networks (LANs). The wireless LANs discussion includes multiple access techniques and computer simulation of radio channels. Prerequisite: ELEN-452 or consent of instructor.

**ELEN-762. Network Matrices and Graphs****Credit 3 (3-0)**

Use of vector space techniques in the description, analysis and realization of networks modeled as matrices and graphs. The course investigates vector space concepts in the modeling and study of networks. The system concept of networks is introduced and explored as a dimensional space consideration in terms of matrices and graphs. Prerequisite: ELEN-400 or equivalent.

**ELEN-764. Power System Planning****Credit 3 (3-0)**

This course presents an overview of the issues and methods relevant to power systems planning. The course reviews the basics of financial analysis, regression analysis, forecasting, and reliability. Special topics relevant to power systems, such as deregulation, peak-load forecasts, load management and representation, and the loss-of-load probability (LOLP) method are also considered. Prerequisite: ELEN-661 or consent of instructor.

**ELEN-785. Masters Special Topics****Credit 3 (3-0)**

This lecture course is used to introduce engineering topics of current interest to master students and faculty. The subject matter will be identified before the beginning of the course. Prerequisite: Consent of instructor.

**ELEN-792. Masters Seminar****Credit 1 (1-0)**

Discussions and reports of subjects in electrical engineering and allied fields will be presented. Prerequisite: Master level standing.

**ELEN-793. Masters Supervised Teaching****Credit 3 (0-3)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Master level standing.

**ELEN-794. Masters Supervised Research****Credit 3 (0-3)**

This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project or thesis topic of the masters student. Prerequisite: Master level standing and consent of instructor.

**ELEN-796. Masters Project****Credit 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project, must be submitted for approval. This course is only available to project option students. Prerequisite: Masters standing and consent of instructor.

**ELEN-797. Masters Thesis****Credit Var. (3-6)**

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Masters thesis. This course is only available to thesis option students. Prerequisite: Consent of advisor.

**ELEN-801. Solid State Devices****Credit 3 (3-0)**

This course deals with p-n junction and Schottky barrier diodes, bipolar junction and field effect transistors, heterostructure devices (e.g., heterojunction bipolar transistors and solar cells), and device modeling and simulation. Prerequisite: ELEN-602 or consent of instructor.

**ELEN-802. Advanced Solid State Theory****Credit 3 (3-0)**

This course presents the physical properties of solids, including crystal lattice structure, atomic bonding, the band theory of electronic conduction, carrier mobilities, and scattering mechanisms. Prerequisite: ELEN-602 or consent of instructor.



**ELEN-803. Compound Semiconductor Materials and Devices      Credit 3 (3-0)**

This course presents the physics of compound semiconductors, epitaxial crystal growth, quantum well and superlattice devices, compound semiconductor FETs, and photonic devices. Prerequisite: ELEN-602 or consent of instructor.

**ELEN-804. Semiconductor Material and Device  
Characterization**

**Credit 3 (3-0)**

This course covers electrical, optical, and physical/chemical characterization of semiconductor materials and devices. Laboratory demonstrations will be presented on selected characterization techniques. Prerequisite: ELEN-602 or consent of instructor.

**ELEN-805. Thin Film Technology for Device Fabrication      Credit 3 (3-0)**

This course will focus on the preparation and properties of thin film electronic materials (dielectrics, metals, epitaxial layers). Topics will include: basic vacuum technology; theories of condensation, nucleation and growth of thin films; deposition techniques (chemical vapor deposition, vaporization, sputtering); epitaxial growth of semiconductor materials (molecular beam epitaxy, vapor phase epitaxy, liquid phase epitaxy); and applications of the deposition processes to the fabrication of heterostructure devices. Prerequisite: ELEN-602 or consent of instructor.

**ELEN-810. Theory and Techniques in Photonics      Credit 3 (3-0)**

This course will concentrate on photonic materials such as semiconductors and oxide materials for opto-electronic integrated optic and nonlinear optic guided wave devices such as lasers, modulators and fibers. The course will also cover photonic systems for computing, communications, sensing, and data acquisition, processing and storage. Prerequisites: ELEN-450 or ELEN-470 and ELEN-602.

**ELEN-821. Advanced Computer Organization and Architecture      Credit 3 (3-0)**

This course introduces the design and performance issues of array processors and multiprocessors. Very Long Instruction Word (VLIW), data-flow machines, array processors, interconnection networks, and memory structures will be discussed. Prerequisite: ELEN-624 or consent of instructor.

**ELEN-822. Error-Correcting Codes      Credit 3 (3-0)**

In this course, the basic principles of coding, such as error control schemes, coding in communication systems, and block coding, are studied. Linear block codes, polynomial algebra and cyclic codes, block codes based on finite field arithmetic, convolution codes, coding for bursty channels, coding for bandwidth limited channels, codes for computer memories and error detection and correction methods will be discussed. Prerequisite: ELEN-625.

**ELEN-823. Advanced VLSI Design      Credit 3 (3-0)**

This course introduces the design of very high performance digital circuits, interconnect modeling, and packaging. Timing issues in digital circuits, designing memory and array structures, reliability and yield predictions, design synthesis, and validation and testing of VLSI circuits will be discussed. Prerequisite: ELEN-629 or consent of instructor.

**ELEN-847. Telecommunication Networks      Credit 3 (3-0)**

The course familiarizes the student with the concepts of the International Standards Organization Open Systems Interconnection (ISO OSI) standards for the seven layer network model. This course introduces techniques for the analysis and optimization of computer networks, and illustrates some of the technical issues of current networks. Prerequisite: ELEN-647.



**ELEN-848. Information Theory** **Credit 3 (3-0)**

This course covers topics in classical information theory such as entropy, source coding, channel coding, and rate distortion theory. Several related topics are discussed, including entropy for Markov sources and entropy for the extension of sources. Prerequisite: ELEN-749.

**ELEN-849. Data Communications** **Credit 3 (3-0)**

This course is an extended study of digital communications. Various topics in the upper level of digital communications, such as channel coding, synchronization, multiplexing, multiple access, and frequency spreading are discussed. Prerequisite: ELEN-749 or consent of instructor.

**ELEN-850. Digital Signal Processing II** **Credit 3 (3-0)**

This course deals with advanced topics in digital signal processing. Topics include the 2-D sampling theorem, the 2-D z-transform, the 2-D discrete Fourier transform, 2-D filters, and computational structures for the implementation of multi-dimensional digital signal processing algorithms. Prerequisite: ELEN-650 or consent of instructor.

**ELEN-857. Pattern Recognition** **Credit 3 (3-0)**

This course covers classical topics in statistical decision function, Bayesian learning, error probability estimation, cluster-seeking, and deterministic approach. Several related topics are discussed, including stochastic approximation, feature selection and ranking, syntactic and structural pattern recognition. Prerequisite: ELEN-657.

**ELEN-861. Power System Control and Protection** **Credit 3 (3-0)**

This course deals with power and voltage control systems, and power systems protection by relays. Related topics are also covered. Prerequisite: ELEN-661 or ELEN-668.

**ELEN-862. Computer Methods in Power Systems** **Credit 3 (3-0)**

This course deals with commercially available software for modeling and analysis of electric power systems. Prerequisite: ELEN-661 or equivalent.

**ELEN-865. Theory of Linear Systems** **Credit 3 (3-0)**

This course introduces modern control system design and analysis. Topics include linear-quadratic regulators, state estimators, and discrete-time control systems. Issues discussed include stability, robustness, and optimality. Prerequisite: ELEN-668 or equivalent.

**ELEN-866. Discrete Time Systems** **Credit 3 (3-0)**

In this course, analyses and syntheses of discrete time systems are carried out using Z-transform and state variable representations. The controllability and observability, stability criteria, sampled spectral densities and correlation sequence, optimum filtering and control of random processes are discussed. Prerequisite: ELEN-668 or equivalent.

**ELEN-867. Neural Networks Design** **Credit 3 (3-0)**

This course covers the design of neural network systems using CMAC (Cerebellum Model Articulation Controller), back propagation, and multifunction hybrid networks. Prerequisite: ELEN-678 or equivalent.

**ELEN-868. Intelligent Methods for Control Systems** **Credit 3 (3-0)**

The course covers advanced control methods for dynamic systems. The focus will be on intelligent control algorithms, and adaptive and self-learning methods. Stability analysis and performance simulation will also be addressed. Prerequisite: ELEN-668 or consent of instructor.

**ELEN-869. Machine Vision for Intelligent-Robotics****Credit 3 (3-0)**

This course is a study of visual/non-visual sensor technologies for the intelligent control of a robot. The course will cover image understanding, non-contact sensor analysis, and data fusion for intelligent robotics system design. Prerequisite: ELEN-657.

**ELEN-870. Fuzzy Logic With Applications****Credit 3 (3-0)**

The course objective is to understand the basic theory and the foundations of fuzzy sets. Fuzzy logic is shown to contain evidence, possibility, and probability logic. This course emphasizes engineering applications in control, decisions-making, and pattern recognition. The hardware/software implementation of those applications is also demonstrated. Prerequisite: ELEN-668 or consent of instructor.

**ELEN-871. Nonlinear Control Systems****Credit 3 (3-0)**

This course explores the basic issues of nonlinear system analysis and control. The course will introduce the general characteristics of nonlinear behavior and some of the tools needed to analyze and understand them. It will also introduce basic concepts of stability theory, especially Lyapunov's. Some basic design techniques for the control of these systems, such as the sliding mode method and feedback linearization, will be introduced. Prerequisite: ELEN-668 or consent of instructor.

**ELEN-885. Doctoral Special Topics****Credit 3 (3-0)**

This lecture course is used to introduce engineering topics of current interest to doctoral students and faculty. The subject matter will be identified before the beginning of the course. Prerequisites: Doctoral student and consent of instructor.

**ELEN-992. Doctoral Seminar****Credit 1 (0-1)**

In this course, doctoral students attend colloquia or seminars. These consist of presentations by doctoral students on dissertation topics and works-in-progress and by guests on important classical, contemporary, or research problems in electrical engineering. Prerequisite: Doctoral level standing.

**ELEN-993. Doctoral Supervised Teaching****Credit 3(0-3)**

Students will gain teaching experience under the mentorship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Doctoral level standing.

**ELEN-994. Doctoral Supervised Research****Credit 3 (0-3)**

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisites: Doctoral level standing and consent of instructor.

**ELEN-995. Doctoral Preliminary Examination****Credit 3 (0-3)**

This course is for students who are preparing for and taking the written and/oral preliminary examination. Prerequisites: Doctoral student and consent of advisor.

**ELEN-997. Doctoral Dissertation****Var. Credit (3-12)**

This supervised research serves as the dissertation of the doctoral student. Twelve credits of dissertation are required for graduation. Prerequisites: Doctoral student and consent of advisor.

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### OBJECTIVE

The objective of the graduate programs in Agricultural & Biosystems Engineering (ABE) is to provide advanced professional studies in the areas of Water Resources Engineering and Bioprocessing.

### DEPARTMENTAL ADMISSION POLICY

The Master of Science in ABE program is open to students with a bachelor's degree in Agricultural & Biosystems Engineering or a closely related field from an institution of recognized standing. In order to pursue a graduate degree in Agricultural & Biosystems Engineering, an applicant must first be admitted to the Graduate School. The initial step toward Graduate School admission is to complete the required application forms and submit them to the Graduate School office. In addition to the application forms, two copies of the student's undergraduate and/or graduate transcript(s) and three recommendation letters are required. The student should also include an essay that describes his/her area of interest and reasons for wanting to pursue a graduate degree.

Processing of applications cannot be guaranteed unless applications are received, with all supporting documents, in the Graduate School office at least fifteen days prior to the beginning of registration for a given semester. Foreign nationals are encouraged to apply early; a minimum of one semester in advance of the anticipated enrollment date is recommended.

### ADMISSION REQUIREMENTS

All applicants for graduate study must have earned a bachelor's degree from a four-year college. Prospective students must follow all current procedures of the School of Graduate Studies.

The minimum requirement for unconditional admission to the Master of Science in Agricultural & Biosystems Engineering Program will be an undergraduate degree from an ABET accredited Agricultural & Biosystems Engineering program with a minimum of 3.0 (out of 4.0) Grade Point Average on the overall undergraduate program of study. The other two categories of admission, provisional and special student, may also be used on a case-by-case basis as described below.

Persons may be admitted provisionally to the MS-ABE program if any of the following conditions apply:

1. The undergraduate degree is not from an ABET accredited program in Agricultural engineering.
2. The undergraduate degree is not engineering but in a closely related curriculum with a substantial engineering science content.
3. Deficiencies revealed in the analysis of the undergraduate transcript may be removed by the inclusion of no more than 12 semester credit hours.

A student admitted provisionally would be required to meet with the Graduate Coordinator to develop a list of undergraduate courses that must be taken to eliminate deficiencies in the undergraduate preparation for graduate study. All provisionally admitted students must earn a 3.0 grade point average on the first nine graduate course credits completed. In addition, a 3.0 grade point average must be earned on all undergraduate courses if any were required as a condition of admission.

Students who do not hold an engineering undergraduate degree may have course deficiencies exceeding 12 semester credits. These students can be considered for special student status until such time that their deficiencies are reduced so that they can qualify for provisional admission. Persons with massive undergraduate deficiencies, even though they might hold an undergraduate degree, are asked to apply as transfer students to the undergraduate Agricultural & Biosystems Engineering program. Make-up courses will be evaluated on a case-by-case basis dependent on the student's area of interest.

Students who are not seeking a graduate degree at NORTH CAROLINA A&T are also classified as special students. They are admitted to take courses for self-improvement. If a student subsequently wishes to pursue a degree program, he/she must request an evaluation of his/her record. The School of Graduate Studies reserves the right to refuse to accept credits earned while being enrolled as a special student towards a degree program; under no circumstances may the student apply towards a degree program more than twelve semester hours of graduate credits earned as a special student.

In addition to the above application material, foreign nationals or people whose mother tongue is not English are required to provide special information concerning English proficiency and finances. Specifically, these applicants are required to take the standardized "Test of English as a Foreign Language" (TOEFL) and achieve a minimum score of 550.

The School of Graduate Studies accepts application from students who already hold a Master's degree in other fields or disciplines, but wish to earn a MS-ABE degree.

Consistent with NORTH CAROLINA A&T's School of Graduate Studies Policy, applicants holding a Master's degree in another engineering discipline from NORTH CAROLINA A&T need only complete 18 credit hours to earn a MS-ABE degree. If the applicant holds an engineering Master's degree from outside NORTH CAROLINA A&T, a maximum of 6 credit hours of course work may be transferred.

## **GENERAL DEPARTMENTAL REQUIREMENTS**

A student pursuing a Master of Science Agricultural & Biosystems Engineering has the following three options:

1. All course work option
2. Project option, and
3. Thesis option

All students pursuing a Master of Science in Agricultural & Biosystems Engineering must complete at least one (1) course of the group of Core Courses, six (6) credit hours of advanced math course (or equivalent math course), and one credit hour Masters Seminar (CIEN 792).

### **Core Courses**

CIEN 644	Finite Element Analysis
AREN 715	Research Methods
CROS 607	Research Methods
AGEN 619	Instrumentation & Measurement
CIEN 702	Civil Engineering System Analysis



## Requirements of the Different Options

All options require a minimum of thirty (30) credit hours and the formation of a formal graduate committee. The graduate committee will consist of the advisor and two additional faculty members selected in agreement between the advisor and the student. The plan of study should be prepared by the student and must be approved by the graduate committee. Specifically, only the courses approved by the graduate committee can be used to satisfy the minimum requirements set forth as “approved course work.” At least half of the credit hours counted in the “approved course work” to satisfy the requirements for a master’s degree must be 700 level courses; that is, courses open only to graduate students. Furthermore, the courses with numbers 790 and above cannot be used to satisfy the “approved course work” requirements, with the only exceptions as listed below:

**All Course Work Option:** This option requires thirty (30) credit hours of “approved course work” plus a comprehensive examination that would be administered by the student’s graduate committee during the last semester in residence.

**Project Option:** The project option requires twenty-seven (27) credit hours of “approved course work” and three credit hours of the Masters Project (CIEN 796). This option is intended for students wishing to investigate a design problem of current interest to industry or to pursue a practical application. These students will have to demonstrate to the committee their capacity to perform and report work adequately.

**Thesis Option:** This option requires twenty-four (24) credit hours of “approved course work”, three (3) credit hours of supervised Masters Graduate Research (CIEN 794) and three (3) credit hours of Masters Thesis (CIEN 797). The student’s graduate committee must formally examine the thesis content and quality, and judge the thesis defense. Furthermore, the thesis should follow the format required by the School of Graduate Studies.

## Grades Required

Grades for graduate students are recorded as follows: A, excellent; B, average; C, below average, but permissible; D, clearly below average and not acceptable; F, failure; S, satisfactory; U, unsatisfactory. All courses CIEN 792 through CIEN 797 will be assigned S or U and will not be counted in the student’s GPA; I, incomplete; W, withdrawal. The following academic requirements are proposed:

1. To earn a degree, a student must have a cumulative average of “B” (3.0 on the 4.0 system).
2. A graduate student is automatically placed on “warning” when his/her cumulative average falls below “B”. The student has one semester to raise his/her average to “B” or above or will be placed on Probation. Probationary status will remove a student’s eligibility for a teaching assistantship.
3. A student may be dropped from the degree program if he/she has not achieved a cumulative GPA of 3.0 at the end of the probationary semester.
4. A student may not repeat a required course in which “C” or a better grade was earned.
5. A student may repeat a required course in which “F” was earned. A student may not repeat the course more than once. If a student achieves less than “C” the second time, he/she is dismissed from the degree program.
6. All hours attempted in graduate courses and all grade points earned are included in the computation of the cumulative average of a graduate student.
7. A student who stops attending a course but fails to withdraw officially will be assigned a grade of “F”
8. All grades of “I” must be removed during the next semester within the prescribed time period.

9. Changing the selected option, for example from thesis to project, requires approval of the Graduate advisor and the Graduate Coordinator and may lead to loss of credit for thesis or project credits.

The graduate program must be completed within six (6) consecutive calendar years. Programs remaining incomplete after this time interval are subject to cancellation, revision, or special examination for outdated work. In the event that studies are interrupted for duty in the armed services, the time limit shall be extended for the length of time the student shall have been on active duty providing the candidates resumes graduate work no later than one year following release from military services.

Student work plans for the remainder of courses will be developed from the following list, based on their area of research or interest:

<b>Course</b>	<b>Title</b>	<b>Credit</b>
AGEN 701	Soil land Water Engineering II	3
AGEN 714	Applied Hydrogeology	3
BIOL 700	Environmental Biology	3
CHEM 722	Advanced Organic Chemistry	3
CIEN 712	Systems Approach in Waste Management	3
CIEN 786	Special Project	1,2,3
CIEN 794	MS Supervised Research	3
CIEN 796	Master Project	3
CIEN 797	Master of Science Thesis	3
CIEN 750	Separation Processes	3
EASC 718	Applied Environmental Microbiology	3
MEEN 733	Radiation Heat transfer	3
AGEN 600	Soil and Water Engineering 1	3
AGEN 619	Instrumentation and Measurement	3
AGEN 624	Water Resources Engineering or CIEN 622	3
CIEN 610	Water and Wastewater Analysis or EASC 622	3
CIEN 614	Stream-water Quality Modeling	3
CIEN 664	Open Channel Flow	3
CIEN 668	Subsurface Hydrology	3
CIEN 699	Special Project	3
CHEN 608	Bio-separation	3
CHEN 625	Basic Food Process Engineering	3
CHEN 645	Environmental Remediation	3
CHEN 655	Industrial Ecology	3
HEFS 631	Food Chemistry	3
MATH 631	Linear & Non-Linear Programming	3
MATH 652	Methods of Applied Mathematics	3
SLSC 632	Soil Physics	3

## **COURSES WITH DESCRIPTION IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING**

### **Advanced Undergraduate and Graduate**

#### **AGEN-600. Soil and Water Engineering I**

**Credit 3 (2-2)**

This course will illustrate measures to improve soil and water use by evaluating and using present conservation practices and models. Water conveying and retaining structures, and soil conservation, drainage and irrigation systems will be discussed and designed. The course will emphasize sound environmental design practices. Prerequisite: AGEN 360 or Consent of Instructor. (F)

#### **AGEN-619. Instrumentation and Measurement**

**Credit 3 (2-2)**

This course will emphasize quantitative evaluation of some of the well established parameters such as temperature, humidity, fluid flow, pressure, displacement, velocity, acceleration, force, stress, strain, etc that are widely used in agricultural and biosystems engineering and other engineering disciplines. Prerequisite: MEEN 336 or CAAE 332. (DEMAND)

#### **AGEN-624. Water Resources Engineering**

**Credit 3 (2-2)**

This course will involve detailed analysis and design of water resources systems. Topics include: water resources planning, and development, hydraulic structures, introduction to aquifer analysis and contamination, well development, pump evaluation and selection, water quality and management, water laws, detention and retention ponds, wastewater management and remediation.

#### **AGEN-701. Soil and Water Engineering II**

**Credit 3 (3-0)**

The design of drainage and irrigation systems and their applicability to specific regions will be addressed. There will be in-depth discussion of saturated and un-saturated flow, and various equations that are used to solve soil water movement. Open channel flow, well hydraulics, and earth dams or embankments will be covered. Prerequisite: AGEN-600 or consent of the instructor.

#### **AGEN-714. Applied Hydrogeology**

**Credit 3 (3-0)**

This course will cover basic principles of groundwater resource evaluation and the approach or techniques used to solve groundwater problems. Discussion will include methods used to quantitatively appraise hydrogeologic parameters affecting water-yielding capacity of wells and aquifers. Various types of aquifers will be discussed under the umbrella of confined and unconfined aquifers. Ground water quality, conservation and contamination will also be covered.

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## English

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### OBJECTIVES

The objectives of the English Department are to provide in-depth training in English Education; English, American, and African-American literature; folklore; and language.

### DEGREES OFFERED

English and African-American Literature - Master of Arts  
English Education - Master of Science

### REQUIREMENTS FOR ADMISSION TO THE M.A. PROGRAM IN ENGLISH AND AFRICAN-AMERICAN LITERATURE AND THE M.S. PROGRAM IN ENGLISH EDUCATION

All applicants to the M.A. and M.S. programs must have earned a bachelor's degree from a four-year college. Applicants must also have completed a minimum of twenty-four (24) undergraduate hours in English. The hours must include at least three semester hours of Shakespeare, three of American literature, three of English literature, three of world literature or contemporary literature, three of advanced grammar, and three of advanced composition.

A student who fails to meet these qualifications will be expected to satisfy the requirements by enrolling in undergraduate courses before beginning graduate studies in English.

Scores for the verbal section of the GRE general test and for the GRE Literature and English test must be submitted for consideration as a part of the admission process.

Application forms may be obtained from the office of the Graduate School, and are also available on-line at the A&T Web-site. Application forms must be completed and returned to the Graduate School Office. Two (2) official transcripts of previous undergraduate or graduate records and three (3) letters of recommendation must be forwarded to the Graduate Office before action can be taken on the application. An applicant may be admitted to the program unconditionally, provisionally, or as a special student.

**Unconditional Admission.** To qualify for unconditional admission to the programs, an applicant must have earned an overall average of 3.0 on a four-point system (or 2.0 on a three-point system) in undergraduate studies.

**Provisional Admission.** An applicant may be admitted to graduate studies on a provisional basis if (1) the record of undergraduate preparation reveals deficiencies that can be removed near the beginning of graduate study, or if (2) the applicant lacks the required grade point average for unconditional admission. The applicant may then become eligible for unconditional admission by successfully completing the first nine (9) hours of course work with a 3.0 or better average. Students admitted provisionally may also be required to pass examinations to demonstrate their knowledge in certain areas or to take special undergraduate courses to improve their background. A minimum grade point average of 2.6 in undergraduate work is required for provisional admission.



*Special Students.* Students not seeking the M.A. or M.S. degree may be admitted in order to take courses for self-improvement or for renewal of teaching certificates. If the student subsequently wishes to pursue the M.A. or M.S. program, he or she must request an evaluation of the work. Under no circumstances may the student apply toward a degree program more than twelve (12) hours earned as a special student.

## **M.A. AND M.S. DEGREE REQUIREMENTS**

*Total Hours Required.* The M.A. and M.S. programs consist of two distinct but similar elements. For the M.A. program, the student may elect to take twenty-seven (27) hours of course work and write a thesis for three (3) hours credit in order to satisfy the thirty-hour minimum requirement. The student may also elect not to write a thesis and take an additional three (3) hours of course work in order to satisfy the thirty-hour minimum requirement. For the M.S. program, the student may elect to take thirty-six (36) hours of course work and write a thesis for three (3) hours credit in order to satisfy the requirement of thirty-nine (39) total hours. The student may also elect not to write a thesis and take an additional three (3) hours of course work in order to satisfy the requirement of thirty-nine (39) hours.

For the M.A. program, three specific English courses are required: ENGL 700 - Literary Analysis and Criticism; ENGL 753 - Literary Research and Bibliography; and ENGL 755 - Contemporary Practices in Grammar and Rhetoric. In addition, the student must take twelve (12) hours in African-American Literature and nine (9) hours in English and American Literature. Moreover, a reading knowledge of French, German, or Spanish is required for the M.A. degree. (The student who elects the thesis option is required to take only nine (9) hours in African-American Literature.)

For, the M.S. program, four specific English courses are required: ENGL 700 - Literary Analysis and Criticism; ENGL 730 - Directed Study in English; ENGL 753 - Literary Research and Bibliography; and ENGL 755 - Contemporary Practices in Grammar and Rhetoric. In addition, five specific courses in Curriculum and Instruction are required: CUIN 619 - Learning Theories; CUIN 711- Research and Inquiry; CUIN 721 - Advanced Methods; CUIN 728 - Technology in K-12 Schools; and CUIN 729 - Diversity Issues in K-12 Schools.

Courses at the 700 level are open only to graduate students. For students in both programs, fifty percent of their course work must be at the 700 level. Therefore, students enrolled in the M.A. program must complete fifteen (15) hours of course work at the 700 level. Students in the M.S. program satisfy this requirement automatically because eight (8) of their required courses, totaling twenty-four (24) hours, are at the 700 level. (Students may apply 700 level professional education courses toward meeting this requirement.) All 600 level courses are open both to senior undergraduate students and to graduate students.

*Grades Required.* Students in the programs must maintain at least a 3.0 grade point average in order to satisfy the grade requirements of the program. If a student receives a C or lower in more than two (2) courses, he or she will be dropped from the program.

*Amount of Credit Accepted for Transfer.* The Graduate School will accept six (6) semester hours of transfer credit from another institution for those students enrolled in degree programs.

*Other Requirements (Comprehensive and Thesis Examinations).* For the M.A. and M.S. degrees, students must pass a three (3) hour written comprehensive examination administered by the English Department. The comprehensive examination will cover only material to which the student has been exposed in course work at A&T. The comprehensive examination may be taken twice. An additional comprehensive examination in education is required of persons pursuing the M.S. degree. Those students who elect to write a thesis must meet the deadlines pro-

jected by the Graduate School in addition to standing for a one-hour oral examination which constitutes a defense of the thesis. The defense may be attempted twice.

## **CAREER OPPORTUNITIES**

Both the M.A. and M.S. degrees prepare students to pursue graduate study for the doctorate in English and related fields. The M.S. prepares students to teach on the secondary and college levels. The M.A. degree is designed primarily to prepare students for college teaching and for admission to doctoral programs.

### **CURRICULUM GUIDE FOR M.A. DEGREE IN ENGLISH AND AFRICAN-AMERICAN LITERATURE**

#### **Non-Thesis Option:** *30 semester hours required*

1. Required: ENGL 700, 753, 755
2. Twelve (12) hrs. from the following: ENGL 650, 652, 654, 656, 658, 660, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 628, 699, 701, 703, 705, 706, 707, 712, 721, 722, 723, 724, 730, 731
4. Foreign Language: Demonstrated proficiency in French, Spanish, or German.

#### **Thesis Option:** *30 semester hours required*

1. Required: ENGL 700, 753, 754
2. Nine (9) hrs. from the following: ENGL 650, 652, 654, 658, 660, 760, 762, 764, 766
3. Nine (9) hrs. from the following: ENGL 603, 620, 628, 662, 702, 704, 720, 749, 750, 751, 752, 755, 770
4. Foreign Language: Demonstrated proficiency in French, Spanish, or German.
5. Thesis Research: ENGL 775 (3 semester hours)

### **CURRICULUM GUIDE FOR M.S. DEGREE IN ENGLISH EDUCATION**

#### **Non-Thesis Option:** *39 semester hours required*

1. Required: ENGL 700, 730, 753, 755
2. Required: CUIN 619, 711, 721, 728, 729
3. One African-American Literature course from the following: ENGL 650, 652, 654, 656, 658, 660, 760, 762, 764, 766
4. One American Literature course from the following: ENGL 628, 721, 722, 723, 724
5. One British Literature course from the following: ENGL 699, 701, 703, 704, 705, 706, 707
6. One additional three-hour course in African-American, American, or British Literature from courses listed in numbers 3, 4, and 5.

#### **Thesis Option:** *39 semester hours required*

1. Required: ENGL 700, 730, 753, 754
2. Required: CUIN 619, 711, 721, 728, 729
3. One African-American Literature course from the following: ENGL 650, 652, 654, 656, 658, 660, 760, 762, 764, 766
4. One American Literature course from the following: ENGL 628, 721, 722, 723, 724
5. One British Literature course from the following: ENGL 699, 701, 703, 704, 705, 706, 707
6. Thesis Research: ENGL 775 (3 semester hours)

## **Courses for Senior Undergraduates and for Graduates**

ENGL 600	Language Variations in American English
ENGL 603	Introduction to Folklore
ENGL 626	Children's Literature
ENGL 627	Literature for Adolescents
ENGL 628	The American Novel
ENGL 650	African-American Folklore
ENGL 652	African-American Drama
ENGL 654	African-American Novel I
ENGL 656	African-American Novel II
ENGL 658	African-American Poetry I
ENGL 660	African-American Poetry II
ENGL 669	Medieval Literature

## **Graduate Courses, Open Only to Graduate Students**

ENGL 700	Literary Analysis and Criticism
ENGL 701	English Renaissance Literature
ENGL 703	Seventeenth-Century English Literature
ENGL 704	Eighteenth-Century English Literature
ENGL 705	Romantic Literature
ENGL 706	Victorian Literature
ENGL 707	Modern British Fiction
ENGL 710	Language Arts for Elementary Teachers I
ENGL 711	Language Arts for Elementary Teachers II
ENGL 712	Teaching of Freshman Writing
ENGL 721	Major American Writers I
ENGL 722	Major American Writers II
ENGL 723	Modern American Poetry
ENGL 724	American Multi-Cultural Literature
ENGL 730	Directed Study in English
ENGL 731	Technology in Teaching and Research in the Humanities
ENGL 753	Literary Research and Bibliography
ENGL 754	History and Structure of the English Language
ENGL 755	Contemporary Practices in Grammar and Rhetoric
ENGL 760	Non-Fiction by African-American Writers
ENGL 762	Short Fiction by African-American Writers
ENGL 764	African-American Aesthetics
ENGL 766	Seminar in African-American Literature and Language
ENGL 770	Seminar
ENGL 775	Thesis Research

## ENGLISH COURSE DESCRIPTIONS

### Advanced Undergraduate and Graduate Courses

- ENGL 600. Language Variations in American English** **Credit 3 (3-0)**  
This course is a survey of regional and social dialects in the United States and a study of their interrelationship; examples of some of the motivations for dialectical divergences, especially in the instance of non-standard dialects; and a consideration of functional varieties and social dialect shifting. Prerequisite: English 310 or graduate standing. (Demand)
- ENGL 603. Introduction to Folklore** **Credit 3 (3-0)**  
(Formerly English 2498)  
This course is a basic introduction to the study and appreciation of folklore. (Cross listed as Anthropology 603). (Summer/alternate years)
- ENGL 626. Children's Literature** **Credit 3 (3-0)**  
(Formerly English 2476)  
This course is a study of the types of literature designed especially for students in elementary, intermediate, and middle schools. (Not accepted for credit toward graduate concentration in English.) Prerequisites: English 101, Humanities 200-201. (Fall; Spring; Summer)
- ENGL 627. Literature for Adolescents** **Credit 3 (3-0)**  
This course acquaints prospective and in-service teachers with a wide variety of good literature that is of interest to adolescents. Emphasis is on thematic approach to the study of literature, continental writers, book selection, and motivation of students to read widely and independently with depth and understanding. Prerequisite: English 101, 200, and 201 or graduate standing. (Fall)
- ENGL 628. The American Novel** **Credit 3 (3-0)**  
(Formerly English 2478)  
This course is a history of the American novel from Cooper to Faulkner; Melville, Twain, Howells, James, Dreiser, Lewis, Hawthorne, Faulkner and Hemingway will be included. Prerequisite: English 210. (Demand)
- ENGL 650. African-American Folklore** **Credit 3 (3-0)**  
This course studies folk tales, ballads, riddles, proverbs, superstitions, and folk songs of African-Americans. Parallels will be drawn between folklore peculiar to African-Americans and that of Africa, the Caribbean, and other nationalities. (Spring)
- ENGL 652. African-American Drama** **Credit 3 (3-0)**  
This course is a detailed study of the dramatic theory and practice of African-American writers against the backdrop of Continental and American trends. Special attention will be given to the works of major figures from the Harlem Renaissance to the present. Works by Bon-temps, Cullen, Hughes, Hansberry, Ward, Davis, Baldwin, Baraka (Jones), Gordone, and Bullins will be included. (Demand)
- ENGL 654. African-American Novel I** **Credit 3 (3-0)**  
This course is an intensive bibliographical, critical, and interpretative study of novels by major African—American writers through 1940. Novelists emphasized include Dunbar, Chestnutt, Toomer, McKay, Larsen, Hurston, Griggs, Fauset, and Wright. (Fall)
- ENGL 656. African-American Novel II** **Credit 3 (3-0)**  
This course is an intensive bibliographical, critical, and interpretative study of novels by major African—American writers after 1940. Novelists emphasized include Wright, Ellison, Baldwin, Himes, Demby, Williams, Walker, Brooks, Petry, Gaines, and Mayfield. (Spring)



**ENGL 658. African-American Poetry I****Credit 3 (3-0)**

This course is an intensive study of African-American poetry from its beginning to 1940, with special attention given to poets of the Harlem Renaissance. Poets to be studied include Terry, Hammon, Wheatley, A.A. Whitman, Horton, Braithwaite, J.W. Johnson, Horne, Fenton Johnson, George Douglas Johnson, McKay, Cullen, Cuney, and Hughes. (Demand)

**ENGL 660. African-American Poetry II****Credit 3 (3-0)**

This course is an intensive study of African-American poetry from 1940 to the present with considerable attention given to the revolutionary poets of the sixties and seventies. Poets to be studied include Hughes, Walker, F.M. Davis, Brooks, Brown, Hayden, Tolson, Lee, Reed, Giovanni, Angelou, Jeffers, Sanchez, Redmond, Fabio, Fields, and Baraka. (Fall)

**ENGL 699. Medieval Literature****Credit 3 (3-0)**

This course is a study of the major English writers of the Middle Ages, including Chaucer, Malory, Langland, the "Gawain" poet, the "Everyman" playwright, and various other writers in the dramatic, religious, lyric, and ballad traditions. (Fall/alternate years)

**Graduate Students Only****ENGL 700. Literary Analysis and Criticism****Credit 3 (3-0)****(Formerly English 2485)**

This course is an introduction to intensive textual analysis of poetry, prose fiction, prose non-fiction, and drama. A study is made of basic principles and practices in literary criticism and of the various schools of criticism from Plato to Eliot. (Summer)

**ENGL 701. English Renaissance Literature****Credit (3-0)**

This course is a study of major prose and poetry, both dramatic and non-dramatic, of the English Renaissance. Writers to be studied include More, Sidney, Spenser, Marlowe, and Shakespeare. (Fall/alternate years)

**ENGL 703. Seventeenth-Century English Literature****Credit 3 (3-0)**

This course is a study of major prose and poetry, both dramatic and non-dramatic, of Seventeenth-Century English. Writers to be studied include Jonson, Donne, Bacon, Webster, Marvell, Milton, and Dryden.

(Summer/alternate years)

**ENGL 704. Eighteenth-Century English Literature****Credit 3 (3-0)****(Formerly English 2487)**

This course is a study of the major prose and poetry writers of the Eighteenth Century in relation to the cultural and literary trends. Dryden, Defoe, Swift, Fielding, Addison, Pope, Johnson, and Blake will be included. (Demand)

**ENGL 705. Romantic Literature****Credit 3 (3-0)**

This course is a study of English Romantic writers. Blake, Wordsworth, Coleridge, Keats, Shelley, Byron, Hazlitt, DeQuincey, and Lamb will be included. (Spring/alternate years)

**ENGL 706. Victorian Literature****Credit 3 (3-0)**

This course is a study of Nineteenth-Century Victorian writing, including poetry, fiction, and non-fictional prose. Writers to be considered will include Tennyson, Browning, Arnold, the Rossettis, Carlyle, Mill, Dickens, the Brontes, Eliot, Thackeray, and Hardy. (Spring/alternate years)

**ENGL 707. Modern British Fiction****Credit 3 (3-0)**

This course is a study of English and Irish writers from the beginning of the Twentieth Century to the present. Authors to be considered include Joyce, Woolf, Forster, Lawrence, Mansfield, and Lessing.

(Summer/alternate years)

**ENGL 710. Language Arts for Elementary Teachers I  
(Formerly English 2488)****Credit 3 (3-0)**

This course is designed to provide elementary school teachers with an opportunity to discuss problems related to the language arts taught in the elementary school. (Not accepted for credit towards concentration in English.) (Summer/alternate years)

**ENGL 711. Language Arts for Elementary Teachers II****Credit 3 (3-0)**

This course is a continuation of the study of relevant language situations with which elementary teachers should be concerned. Emphasis will be placed on strategies for guiding pupils to explore the nature and structure of language and for teaching essential language skills. (Not accepted for credit towards concentration in English.) (Summer/alternate years)

**ENGL 712. Teaching of Freshman Writing****Credit 3 (3-0)**

This course is required of all English graduate teaching assistants (GTAs), and is designed solely to provide an academic setting for the theoretical and practical components of teaching English 100. GTAs will discuss and implement writing assignments, exercises in literature and grammar, and the methods of leading class discussion. (Fall)

**ENGL 721. Major American Writers I****Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretive study of works by major American writers through 1900. Writers to be discussed will vary, and will include Bradstreet, Taylor, Poe, Hawthorne, Clemens, Whitman, Melville, Thoreau, Dickinson, and James, among several others. (Fall)

**ENGL 722. Major American Writers II****Credit 3 (3-0)**

This course is an intensive bibliographical, critical, and interpretive study of works by major American writers from 1900 to the present. Writers to be discussed will vary, and will include Fitzgerald, Hemingway, Faulkner, Miller, Cummings, Frost, Updike, Oates, and Carver, among several others. (Spring)

**ENGL 723. Modern American Poetry****Credit 3 (3-0)**

This course is an intensive study of Twentieth-Century American poetry. Special attention will be given to major movements, definitions of modernism, and individual poets. Authors to be considered include Frost, Eliot, Moore, Hughes, Williams, Brooks, and Dove. (Summer)

**ENGL 724. American Multi-Cultural Literature****Credit 3 (3-0)**

This course will examine the critical and historical perspectives of selected works by Native American, Asian American, and Hispanic (including American Chicano, Latino, and Puerto Rican) authors. Writers to be studied include Black Elk, Paula Gunn Allen, Joy Harjo, Louise Erdrich, N. Scott Momaday, Simon Ortiz, Leslie Marmon Silko, James Welch, Maxine Hong Kingston, Frank Chin, Amy Tan, Jose Garcia Villa, Rudolfo Anaya, Pat Mora, Tomas Rivera, Gary Soto, Victor Cruz Hernandez, and Sandra Cisneros. (Summer)

**ENGL 730. Directed Study in English****Credit 3 (3-0)**

This course provides an opportunity for students to pursue in-depth study in literary criticism, literature, linguistics, or writing. Also, work done in this course may serve as ground work for students pursuing the thesis option, developing a portfolio, or acquiring practicum experience. Repeatable once upon approval of departmental chair and/or coordinator of graduate studies

in English. Prerequisite: approval of, and prior consultation with, instructor. (Fall, Spring, Summer)

**ENGL 731. Technology in Teaching and Research in the Humanities** **Credit 3 (3-0)**

This course offers students the opportunity to develop and apply advanced technology in the areas of teaching and/or research in the humanities. Applications include the following: virtual reality, hypertext, hypermedia, distance learning, web-enhanced teaching, advanced research techniques, and hypertext bibliographies. Prerequisite: approval of instructor. (Spring)

**ENGL 753. Literary Research and Bibliography** **Credit 3 (3-0)**  
**(Formerly English 2493)**

This course is an introduction to tools and techniques used in investigation of literary subjects. (Fall)

**ENGL 754. History and Structure of the English Language** **Credit 3 (3-0)**  
**(Formerly English 2494)**

This course is a study of the changes in the English language — syntax, vocabulary, spelling, pronunciation, and usage — from the Fourteenth century through the Twentieth century. (Demand)

**ENGL 755. Contemporary Practices in Grammar and Rhetoric** **Credit 3 (3-0)**  
**(Formerly English 2495)**

This course is designed to provide secondary teachers of English with experiences in linguistics applied to modern grammar and composition. (Spring)

**ENGL 760. Non-fiction by African-American Writers** **Credit 3 (3-0)**

This course studies non-fiction by African-American writers, including slave narratives, autobiographies, biographies, essays, letters, and orations. (Demand)

**ENGL 762. Short Fiction by African-American Writers** **Credit 3 (3-0)**

This course is an intensive examination of short fiction by African-American writers. Among those included are Chesnutt, Dunbar, Toomer, Hurston, McKay, Hughes, Bontemps, Wright, Clarke, Ellison, Fair, Alice Walker, Ron Milner, Julia Fields, Jean W. Smith, Petry, Baldwin, Kelley, and Baraka. (Spring/alternate years)

**ENGL 764. African-American Aesthetics** **Credit 3 (3-0)**

This course defines those qualities of African-American literature that distinguish it from traditional American literature through an analysis of theme, form, and technique as they appear in a representative sample of works by African-American writers. (Demand)

**ENGL 766. Seminar in African-American Literature and Language** **Credit 3 (3-0)**

This is a topics course that will vary; focus will be on prominent themes and/or subjects treated by African-American writers from the beginning to the present. An attempt will be made to characterize systematically the idiom (modes of expression, style) of African-American writers. (Demand)

**ENGL 770. Seminar** **Credit 3 (3-0)**  
**(Formerly English 2499)**

This course provides an opportunity for presentation and discussion of a thesis, as well as selected library or original research projects from non-thesis candidates. Prerequisite: 15 hours of graduate-level courses in English. (Demand)

**ENGL 775. Thesis Research (Demand)** **Credit 3 (3-0)**

Nancy L. Glenz, Chairperson  
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(336) 334-7550  
[glenzn@ncat.edu](mailto:glenzn@ncat.edu)

### OBJECTIVES

1. To develop advanced competencies in organizing and utilizing technical education strategies and methods.
2. To further develop understandings and applications of objectives, principles, concepts, practices, and philosophies of Vocational and Technical Education.
3. To further develop competencies in organizing, directing, and evaluating Technical Education programs, courses, and teaching-learning activities.
4. To develop proficiencies in utilizing technological-educational problem solving and research techniques in Industrial, Vocational, and Technical Education programs.
5. To further develop depth and/or breadth in technological competencies in the various fields of Technology Education.

### DEGREES OFFERED

Technology Education - Master of Science

Vocational-Industrial Education - Master of Science

### GENERAL PROGRAM REQUIREMENTS

- A. Unconditional Admission for "Advanced Licensure" in Technology Education or Vocational Industrial Education
  1. Baccalaureate degree from accredited undergraduate institution.
  2. Satisfactory scores on the "general" section of the GRE or other authorized examination.
  3. Class A license in Technology Education or Vocational-Industrial Education.
  4. Satisfactory completion of all Graduate School requirements for admission to candidacy for a degree.
  5. Failure to meet any of these criteria may necessitate rejection of the application or the requirement of additional undergraduate work.
- B. Provisional Admission for "Advanced Licensure"

Applicants who enter Technology Education and desire "Advanced licensure must hold or be qualified to possess the Class A license in the appropriate Technology Education Option. Students are advised of graduate and undergraduate course requirements necessary to qualify for specific North Carolina "A" and "Advanced Licensure" teaching or director licenses in Technology Education.

### DEPARTMENTAL REQUIREMENTS

*Technology Education Major.* Masters degree candidates must complete a minimum of 39 semester hours of graduate level courses, which include: a 12 semester hour concentration of Technology Education courses leading to "advanced licensure" in Technology Education teaching. Other course requirements must include 12 semester hours of professional education



courses and 15 semester hours in required courses for the thesis or non-thesis option. The grade point average in the graduate program must be 3.0 or better. (See license note below.)

*Vocational-Industrial Education Major.* Masters degree candidates must complete a minimum of 39 semester hours of graduate level courses, which include: a 12 semester hour concentration of Vocational Industrial Education courses leading to advanced licensure for either Trade and Industrial teachers or Local Directors of Vocational Education. Other course requirements must include 12 semester hours of professional education courses and 15 semester hours in required courses for the thesis or non-thesis option. The grade point average in the graduate program must be 3.0 or better. (See certification note below).

Persons with technical preparation and interest in post secondary education or technical training programs in private industry, which do not require teacher licensure by the State of North Carolina, may pursue a masters degree in Vocational Industrial Education Option III, but will not be qualified to receive either “A” or advanced teaching licenses.

*Note: Candidates pursuing Masters degrees in either Technology Education or Vocational Industrial Education may also qualify for North Carolina license in Industrial Cooperative Education/Work Development.*

## CAREER OPPORTUNITIES

Excellent employment opportunities exist for persons holding advanced degrees in all areas of Technology Education. Public schools in North Carolina and elsewhere are in constant need of securing certified teachers, supervisors, and administrators for Technology programs.

Many career opportunities also exist for Technology Education specialists in occupations that do not require state teacher certification. These persons are employed as teachers, training directors, supervisors, and managers in post secondary schools and colleges or in the private sector of industry.

## CURRICULUM

### Required Core Courses

#### All Options (27 semester hours)

#### Professional Education Courses:

CUIN 619	Learning Theories	3 sh
CUIN 721	Advanced Methods	3 sh
CUIN 711	Research and Inquiry: Fundamentals for Teachers	3 sh
CUIN 729	Diversity Issues in Public Schools	<u>3 sh</u>
		12 sh

#### Required courses for Thesis Option:

TECH 672	Curriculum Development in Technological Education	3 sh
TECH 762	Evaluation of Technological Education Programs	3 sh
TECH 767	Research and Literature in Technological Education	3 sh
TECH 769	Thesis Research	3 sh
TECH 768	Technological Seminar	<u>3 sh</u>
		sub total 15 sh

#### Required courses for Non-thesis Option

TECH 672	Curriculum Development in Technological Education	3 sh
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TECH 762	Evaluation of Technological Education Programs	3 sh
TECH 767	Research and Literature in Technological Education	3 sh
TECH 717/718	Special Problems I/II	3 sh
TECH 768	Technological Seminar	<u>3 sh</u>
		sub total 15 sh

**Major Concentrations** (12 semester hours required from selected specialty options)

(Select 12 semester hours from the following list or other appropriate graduate courses in consultation with graduate advisor. Each course in the list is 3 semester hours.)

**Specialized courses in Technology Education:**

TECH 608	Study of Technology
TECH 617	Introduction to Coordination of Industry and Education Partnerships
TECH 618	Technological Education for Special Needs Students
TECH 619	Construction Systems for Technological Education
TECH 620	Manufacturing Systems for Technological Education
TECH 621	Communication Systems for Technological Education
TECH 622	Transportation Systems for Technological Education
TECH 623	Research and Development in Technological Education
TECH 626	Curriculum Modification in Technological Education for Special Needs Population
TECH 664	Occupational Exploration for Middle Grades
TECH 665	Middle Grades Industrial Laboratory
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 682	Computer Applications for Education and Industrial Training
TECH 715	Advanced Research and Development Practices for Technological Education
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 731	Advanced Graphic Techniques
TECH 763	Technological Education for Elementary Grades
GCS 630	Multimedia and Videography
GCS 631	Advanced Computer Aided Design
GCS 632	Graphic Animation
GCS 634	Advanced Multimedia and Videography
GCS 635	Advanced Principles of Graphic Communications Technology
GCS 636	Electronic Imaging and Distance learning
GCS 670	Electronic Imaging and Graphic Communication
GCS 719	Seminar in Computer Aided Drafting and Design

**Specialized courses in Vocational Industrial Education:**

**Option I: Trade and Industrial Education**

GCS 601	Advanced Flexography Methods
GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
GCS 616	Electronic Imaging and Graphic Communication
GCS 630	Multimedia and Videography
GCS 631	Advanced Computer Aided Design

GCS 632	Graphic Animation
GCS 633	Advanced Machine Design and Drafting
GCS 634	Advanced Multimedia and Videography
GCS 635	Advanced Principles of Graphic Communications Technology
GCS 636	Electronic Imaging and Distance Learning
GCS 644	Advanced Architectural Drafting and Design
GCS 719	Seminar in Computer Aided Drafting and Design
GCS 731	Advanced Graphic Techniques
TECH 660	Career Development and Work-based Learning
TECH 661	Workforce Development Program Planning and Management
TECH 663	History and Philosophy of Technological Education
TECH 664	Occupational Exploration for Middle Grades
TECH 665	Middle Grades Industrial Laboratory
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 670	Introduction to Workplace Training and Development
TECH 671	Methods and Techniques of Workplace Training and Development
TECH 682	Computer Applications for Education and Industrial Training
TECH 717	Special Problems I
TECH 718	Special Problems II
CUIN 605	Concepts in Career Education

#### **Option II: Vocational Education Director**

GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
GCS 719	Seminar in Computer Aided Drafting and Design
TECH 663	History and Philosophy of Technological Education
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 764	Administration and Supervision of Technological Education
ADED 773	Leadership
CUIN 612	Instructional Design
CUIN 709	Administration and Supervision
CUIN 723	Principles of Teaching

#### **Option III: Technical Education (Postsecondary/Private Industry)**

GCS 610	Internship in Industry I
GCS 611	Internship in Industry II
TECH 663	History and Philosophy of Technological Education
TECH 669	Safety in the Instructional Environment of Technological Education
TECH 670	Introduction to Workplace Training and Development
TECH 671	Methods and Techniques of Workplace Training and Development
TECH 682	Computer Applications for Education and Industrial Training
TECH 717	Special Problems I
TECH 718	Special Problems II
TECH 764	Administration and Supervision of Technological Education
TECH 766	Curriculum Laboratories in Industrial Settings
ADED 714	The Community College and Postsecondary Education

ADED 773	Leadership
ADED 776	Principles of College teaching
ADED 777	Seminar in Higher Education
ADED 778	Student Personnel Services
ADED 779	Technical Education in Community Colleges

**TOTAL**

**39**

**Note:** GCS 667 Independent Studies in Technological Education I and GCS 668 Independent Studies in Technological Education II may be substituted for selected courses with consent of advisor.

## **COURSES WITH DESCRIPTION IN GRAPHIC COMMUNICATION SYSTEMS AND TECHNOLOGICAL STUDIES**

### **Advanced Undergraduate and Graduate**

#### **GCS-601. Advanced Flexographic Methods Credit 3 (1-4)**

This course is designed to develop advanced proficiency in flexographic printing. It includes the prediction of future flexographic markets, products, substrates, inks, solvents, and industry standards for color processing.

#### **TECH-608. Study of Technology Credit 3 (2-2)**

This course emphasizes contemporary methods of developing problem solving skills through the four technologically adaptive systems (communications, construction, manufacturing, transportation), mathematics and science.

#### **TECH-610. Internship in Industry I Credit 3 (0-7)**

Students participate in an industrial setting during a semester in his major field of interest. He/she will be evaluated during the internship and keep a field diary of events and experiences. Three semester hours is the maximum to be earned during semester.

#### **TECH-611. Internship in Industry II Credit 3 (0-7)**

Students participate in an industrial setting during a semester in his major field of interest. He/she will be evaluated on reports from industry and a field diary of events and experiences. Three semester hours is the maximum to be earned during a semester.

#### **TECH-617. Introduction to Coordination of Industry and Education Partnerships Credit 3 (3-0)**

This course examines the interrelationship, organizational structure, and logistics of industry and education partnerships. Topics include establishing guidelines, developing networks, coordinating personnel, supervising participants, and evaluating performance.

#### **TECH-618. Technological Education for Special Needs Students Credit 3 (3-0)**

Opportunities are provided for teachers, counselors, and administrators to improve their skills in working with disadvantaged/handicapped learners in technological education. Emphasis will be placed on motivational and creative instructional strategies, discipline, drug awareness, and module development.

#### **TECH-619. Construction Systems for Technological Education Credit 3 (2-2)**

The evolution of construction and construction systems on human and societal development will be discussed. Teaching strategies regarding construction systems including design, engineering, site preparation, foundations, superstructure, mechanical systems, and clearing and



finishing the structure will be studied. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

**TECH-620. Manufacturing Systems for Technological**

**Education**

**Credit 3 (2-2)**

This course will cover the organization, product design, and production systems associated with manufacturing. It will emphasize teaching strategies and curriculum development in relation to manufacturing systems. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

**TECH-621. Communication Systems for Technological**

**Education**

**Credit 3 (2-2)**

This course studies the communication systems model and its application to sending and receiving messages. Topics include planning and producing graphically and electronically generated messages to individual and mass audiences. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

**TECH-622. Transportation Systems for Technological**

**Education**

**Credit 3 (2-2)**

The significance of the evolution of transportation and transportation systems on human and societal development will be studied. Topics include the roles of land, air, water, space, and energy systems on rural, urban, and suburban lifestyles. Laboratory activities will be included appropriate for secondary, post-secondary, and industrial settings.

**TECH-623. Research and Development in Technological**

**Education**

**Credit 3 (2-2)**

This is a synthesis course where students research problems relative to any one of the four technological systems (Communications, Transportation, Construction, Manufacturing) and develop solution(s) to the identified problem(s). The interrelationship among the four technological systems will be explored. Laboratory activities will be included as appropriate for secondary, post-secondary, and industrial settings.

**TECH-626. Curriculum Modification in Technological Education for Special**

**Needs Populations**

**Credit 3 (3-0)**

This course examines program modifications for disadvantaged/handicapped learners in technological education. Topics include curriculum adaptation, instructional planning, teaching strategies, media development, and performance assessment for special needs learners.

**GCS-630. Multimedia and Videography**

**Credit 3 (2-2)**

This course covers the development and utilization of multimedia presentations and videography in the educational environment. Topics include principles of composition, planning, editing, and producing multimedia presentations appropriate for educational or industrial settings. Computers and software packages will be used to develop the presentations.

**GCS-631. Advanced Computer-Aided Design**

**Credit 3 (2-2)**

This course focuses on developing knowledge and skill with computer software used with solid modeling and the use of computer software to generate these models. Emphasis will also be placed on the creation of wire-frame and surface models. Analysis, fabrication and documentation of these models will be addressed.

**GCS-632. Graphic Animation**

**Credit 3 (2-2)**

This course deals with the creation and manipulation of computer generated geometric shapes and models. Topics include creation of 3D scenes, assignment of materials, lights and textures, keyframing, rendering, and animation.

**GCS-633. Advanced Machine Design and Drafting** **Credit 3 (2-2)**

This course covers advanced drafting and design techniques associated with machine components and assembly. Topics include tool design and material selection, work-holding principles, design of jigs, fixtures and press working tools, inspection and gaging, joining processes, modular tooling, and economics of design.

**GCS-634. Advanced Multimedia and Videography** **Credit 3 (2-2)**

This course provides advanced strategies and techniques in the development of multimedia presentations and videography. State of the art equipment will be used in addition to computers and software packages to produce professional presentations.

**GCS-635. Advanced Principles of Graphic Communications Technology** **Credit 3 (2-2)**

Advanced principles in graphic reproduction. Study of color applications, photographic applications, design and pre-press techniques. Technical experiences in reproduction methods and quality control.

**GCS-636. Electronic Imaging in Distance Learning** **Credit 3 (2-2)**

This course integrates the strategies and techniques of electronic imaging into distance learning applications. Areas of emphasis include Web page development and management unique to distance learning delivery systems for the internet.

**GCS-637. Industrial and Customer Relations in Graphic Communications** **Credit 3 (3-0)**

This course focuses on industrial and customer relations within the field of graphic communications. Responsibilities and duties of the manager and his/her relationship to higher-level supervisors, subordinates, associates and customers are examined. Emphasis is placed on developing skills essential for persuasive communication.

**GCS-644. Advanced Architectural Drafting and Design** **Credit 3 (2-2)**

This course covers advanced drafting and design techniques associated with the building industries. Topics include the development of working drawings, site plans, elevations, sections, and details in accordance with building codes. Upon completion the student should be able to plan and develop architectural drawings that comply with accepted architectural standards and procedures.

**TECH-660. Career Development and Work-based Learning** **Credit 3 (3-0)**

This course covers implementation strategies for various work-based learning programs that will prepare youth to enter the workplace. Emphasis will be placed on going beyond the classroom into the community to develop workplace knowledge and skills.

**TECH-661. Workforce Development Program Planning and Management** **Credit 3 (3-0)**

This course covers principles and strategies of program planning and management for workforce development. Emphasis will be placed on scheduling, federal and state regulations, procedures and special issues.

**TECH-662. Technological Education Course Construction** **Credit 3 (3-0)**

Selecting, organizing, and integrating objectives, content, media and materials appropriate to technological courses will be discussed. Topics include strategies and techniques of designing and implementing group and individual teaching-learning activities, constructing teacher-made instructional aides and devices, and curriculum planning and design.

**TECH-663. History and Philosophy of Technological Education Credit 3 (3-0)**

This course examines the chronological and philosophical development of technological education with special emphasis on its growth and function in American schools.

**TECH-664. Occupational Exploration for Middle Grades Credit 3 (3-0)**

Designed for persons who teach or plan to teach middle grades occupational exploration programs. Emphasis will be placed on occupational exploration in the curriculum, sources and uses of occupational information, approaches to middle grades teaching, and philosophy and concepts of occupational education.

**TECH-665. Middle Grades Industrial Laboratory Credit 3 (3-0)**

Course organization, teaching strategies, resource and facilities for teaching industrial-technological career exploration in Middle Grades is stressed. Emphasis is on occupational clusters in manufacturing, construction, communication, transportation, fine arts, and public service.

**GCS-667. Independent Studies in Technological Education I Credit 3 (3-0)**

This course involves intensive study in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

**GCS-668. Independent Studies in Technological Education II Credit 3 (3-0)**

This course involves intensive inquiry in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

**TECH-669. Safety in the Instructional Environment of Technological Education Credit 3 (3-0)**

This course examines the principles and techniques of organizing and supervising safety in technological education. Topics include instructional strategies, state and national laws, special hazards, color coding, and accident analysis.

**GCS-670. Electronic Imaging in Graphic Communication Credit 3 (2-2)**

Theory, principles and practices of electronic non-impact printing are investigated in class. Students will be given opportunities to explain, visit and utilize current non-impact printing systems through visits to industrial settings, classroom projects and special demonstrations.

**TECH-670. Introduction to Workplace Training and Development Credit 3 (3-0)**

Overview of the field of training and development. Management concerns related to organizing, operating, and financing training and development programs are discussed. Roles common to practitioners across the broad field of Human Resource Development are covered. Interpersonal perspectives and implications for the future are included.

**TECH-671. Methods and Techniques for Workplace Training and Development Credit 3 (3-0)**

Emphasis on the methods and techniques common to exemplary training programs. Designing learning programs and selecting appropriate media methods and resources using sound theoretical framework is the goal. Evaluation of programs and instruction is discussed.

**TECH-672. Curriculum Development Using Microcomputers in Technological Education Credit 3 (3-0)**

This course will focus on the theory, principles, concepts and philosophy of curriculum development. Topics include utilization of microcomputers, creation of learning activity packages, and integration of resources.



**TECH-682. Computer Applications for Education and Industrial Training**

**Credit 3 (2-2)**

This course deals with strategies and techniques for the utilization of the computer for net-working, videoconferencing, and distance learning. It also covers satellite and teleconferencing in addition to information services and the Internet as vehicles to assist in the educational process.

**GRADUATE STUDENTS ONLY**

**TECH-715. Advanced Research and Development Practices for Technological Education**

**Credit 3 (3-0)**

This course is concerned with research and problem-solving related to technical subsystems of technological education. Emphasis is placed on research procedure and techniques, innovations or inventions, and the results from the research.

**TECH-717. Special Problems I**

**Credit 3 (3-0)**

This course is an advanced study in modern technology that deals with recent developments, trends, practices and procedures in industries. Learning activities include individual and group research and experimentation involving selection, design, development, and evaluation of technical reports and instructional materials.

**TECH-718. Special Problems II**

**Credit 3 (3-0)**

Individual study related to modern technology including research and experimentation involving selection, design, development, and evaluation of instructional materials will be the focus of this course.

**TECH-719. Seminar in computer Aided Drafting and Design**

**Credit 3 (2-2)**

This course surveys the CADD software packages currently used in industrial and educational fields. It explores the uses and applications of these packages, and covers the transfer of data across platforms. Strengths of various software packages for special situations are emphasized.

**GCS-731. Advanced Graphical Techniques**

**Credit 3 (2-2)**

This course is designed to study the applications of American National Standards Institute (ANSI) and International Standards Organization (ISO) drafting standards, computer aided graphical problem solving techniques, drafting methods in certain specialty areas, and different conventions related to tolerancing. Use of literature and research is expected.

**GCS-733. Graphic Communications Organization and Management**

**Credit 3 (3-0)**

This course discusses formal and informal organizations, group dynamics, motivation, and managing conflict and change. Emphasis will be placed on different management practices and leadership styles as they relate to satisfaction and morale, organizational effectiveness, productivity, and profitability in the graphic communications industry.

**TECH-762. Evaluation of Technological Education Programs**

**Credit 3 (3-0)**

This course examines standards, criteria, and strategies for evaluating technological education curricula, facilities, personnel, and programs. Activities include designing and conducting.

**TECH-763. Technological Education for Elementary Grade**

**Credit 3 (3-0)**

This course includes the rationale, philosophy, concepts, curricula, resources, learning activities, methods, and evaluation for technological education in the elementary grades.



**TECH-764. Supervision and Administration of Technological Education**

**Credit 3 (3-0)**

This course examines the relationship of technological education to the general curriculum and the administrative responsibilities involved. Courses of study, costs, coordination problems, class and laboratory organization, and the development of an effective program of supervision will be emphasized.

**TECH-765. Evaluation of Training in Industrial Settings**

**Credit 3 (3-0)**

Study and application of principles of evaluation in industrial training settings. Emphasis is placed on test construction, measurement techniques, and evaluation results.

**TECH-766. Curriculum Laboratories in Industrial Settings**

**Credit 3 (3-0)**

Development and preparation of instructional materials for industrial classroom use. Students select and develop significant areas of instruction for use in industrial settings. Modularized instruction that relates to industrial settings is studied for use and application in the private sector of business and industry. Opportunities are provided for review of actual industrial training materials.

**TECH-767. Research and Literature in Technological Education**

**Credit 3 (3-0)**

This course studies research techniques applied to technical and educational papers and thesis classification of research. Topics include selection of subjects; delineation and planning of procedures; collection, organization and interpretation of data; and review of literature in technological education.

**TECH-768. Technological Seminar**

**Credit 3 (3-0)**

This course is designed to enable non-thesis graduate majors to conclude educational and technical investigations. Each student is expected to plan and complete a research paper and present a summary of the findings to the seminar. Prerequisite: TECH 767.

**TECH-769. Thesis Research**

**Credit 3 (3-0)**

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## Health, Physical Education and Recreation

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### OBJECTIVES

The objectives of graduate study in the Department of Health, Physical Education and Recreation are:

1. To provide knowledge of statistics, research and scientific foundations in Physical Education
2. To integrate physical education with general education through an interdisciplinary curriculum.
3. To provide physical education specializations in administration, teacher education, applied human performance, and adapted physical education.
4. To provide computer technology experiences for the students in the program.

### DEGREE OFFERED

Health and Physical Education - Master of Science

### GENERAL PROGRAM REQUIREMENTS

Persons applying for graduate study in the Department of Health Physical Education and Recreation at North Carolina A&T State University must obtain an application for admittance from the School of Graduate Studies. A student wishing to be accepted as a candidate for the Teaching option must hold a Class A teaching certificate. If a person does not qualify for certification appropriate undergraduate or graduate courses may be taken to correct this deficiency. Applicants must make satisfactory scores on the GRE or other authorized examinations.

### DEPARTMENTAL REQUIREMENTS

The non-thesis option requires 39 semester hours and the thesis option requires 42 semester hours. The graduate program offers five options:

- M.S. in Physical Education/Teacher Education
- M.S. in Physical Education/Teacher Education in Adapted Physical Education
- M.S. in Physical Education/Professional Non-Teaching
- M.S. In Physical Education/Professional Non-Teaching in Adapted Physical Education
- Teaching Licensure Only/Lateral Entry

**Non-Teaching**—A student may complete the Master's Degree in the non-teaching option without meeting state licensure requirements for teaching. This option is designed for individuals working in the field or related fields where a teaching license is not required. This option will not lead to any form of teacher licensure.

**Licensure Only**—The Licensure Only option is available to those individuals wishing to satisfy North Carolina teaching licensure requirements. Individuals must possess an earned undergraduate degree and must remove undergraduate deficiencies at the beginning of his/her graduate studies. Students pursuing licensure must apply for admission to the Teacher Education Program and pass Praxis II prior to pursuing student teaching.

### CAREER OPPORTUNITIES

A degree in this field provides content for students preparing for careers in the public schools, college and junior college teaching, research, public service and further academic advancement.

### COURSES

#### Advanced Undergraduate

#### Health EducationCredits

PHED 651	Personal School and Community Health Problems	3
PHED 652	Methods and Materials in Health Education for Elementary School Teachers	3

#### Graduate Only

PHED 700	Evaluation of Atypical Motor Performance	3
PHED 721	Current Problems and Trends in Physical Education	3
PHED 723	Supervision in Health and Physical Education	3
PHED 731	Exercise Physiology	3
PHED 732	Sport Psychology	3
PHED 733	Motor Learning and Performance	3
PHED 742	Administration of Interscholastic and Intercollegiate Athletics	3
PHED 760	Program Development in Adapted Physical Activity	3
PHED 761	Early Childhood Adapted Physical Activity	3
PHED 762	The Teaching of Adapted Physical Activity	3
PHED 784	Research Statistics for Physical Education	3
PHED 785	Research Methods in Physical Education	3
PHED 786	Scientific Foundations of Human Movement	3
PHED 798	Research Seminar	3
PHED 799	Thesis	3

### DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

#### Advanced Undergraduate and Graduate Courses

**PHED-651. Personal, School and Community Health Problem   Credit 3 (3-0)**  
This course is designed to examine and assess personal, school and community health problems. Emphasis is placed on the development of a personal health profile, contemporary health issues affecting students in grades K-12 and the examination of community agencies. The course includes campus based and field experiences.

**PHED-652. Methods and Materials in Health Education for  
Elementary and Secondary School Teachers** **Credit 3 (3-0)**

A study of the fundamentals of the school health program, pupil needs, methods, planning instruction, teaching techniques, and selection and evaluation of materials for the elementary and secondary programs, and the use of community resources.

**PHED-700. Evaluation of Atypical Motor Performance** **Credit 3 (2-2)**

This course is designed to study the various methods of assessing and evaluating atypical motor performance. Emphasis is placed on ecologically-based data collection, interpretation, and instruction. A practicum is required.

**PHED-721. Current Problems and Trends in Physical Education** **Credit 3 (3-0)**

This course is designed for experienced teachers to address problems in teaching and coaching on all educational levels. Trends and the future direction of the profession will be addressed through research and class discussion.

**PHED-723. Supervision in Health and Physical Education** **Credit 3 (3-0)**

This course is an in depth study of management theories and policies applicable to the administration of Health and Physical Education classes at all levels elementary through higher education. The planning, implementing and evaluating of classroom activities are emphasized.

**PHED-731. Exercise Physiology** **Credit (2-1)**

This course is designed to give the student an understanding of the application of principles and theories of physiology as it applies to the physical training and conditioning of athletes for sports participation.

**PHED-732. Sport Psychology** **Credit 3 (3-0)**

This course is the study of current and classical theories of sport psychology as applied to human performance. Emphasis is placed upon motivation, attention, anxiety, human factors and cognitively based psychological skills training programs

**PHED-733. Motor Learning and Performance** **Credit 3 (3-0)**

This course is the study of current theories and principles of human motor behavior as applied to the acquisition and analysis of motor skills. Emphasis will be placed upon learning concepts, practice, arousal, methodology, transfer and distribution.

**PHED-742. Administration of Interscholastic and  
Intercollegiate Athletics** **Credit 3 (3-0)**

This course is designed to provide management theories and principles for the organization and administration of interscholastic and intercollegiate athletics. The components of budgeting, scheduling, staffing, coordination, planning and legal liability will be thoroughly discussed.

**PHED-760. Program Development in Adapted Physical Activity** **Credit 3 (2-2)**

This course is designed to study the various approaches in developing adapted physical activity programs for individuals with disabilities, with emphasis on ecological approach. Content focus is placed on inclusion, diversity, and non-categorical elements of program development, implementation, and evaluation. A practicum is required.

**PHED-761. Early Childhood Adapted Physical Activity** **Credit 3 (2-2)**

This course focuses on the planning, implementation and evaluation of inclusive motor development programs for very young children with special needs. Emphasis is placed on current practices in assessment and programming, family involvement, and playground safety. A practicum is required.



**PHED-762. The Teaching of Adapted Physical Activity** **Credit 3 (1-4)**

This course is designed to study and apply various instructional approaches to the teaching of adapted physical activity in an inclusive setting. Emphasis is placed on instructional styles and strategies, organizational techniques, and teaching effectiveness within an ecological framework. Internship is required.

**PHED-784. Research Statistics for Physical Education** **Credit 3 (3-0)**

This course is designed to give the student a sound foundation in the principles and applications of various statistical methods as they relate to conducting and evaluating research in Physical Education. The course includes descriptive statistics, probability theory, sampling distribution, inferences about means and standard deviations, hypothesis testing, regression, correlation, Chi-square and non-parametric methods.

**PHED-786. Scientific Foundations of Human Movement** **Credit 3 (3-0)**

This course is designed to discuss and explore the scientific base and approaches to studying human movement, including ethical decision making in human movement research.

**PHED-798. Research Seminar** **Credit 3 (3-0)**

This course is designed to provide the students with a culminating experience by conducting writing and presenting a research project to a forum of students and faculty. Prerequisites: Cuin 711, PHED 784, PHED 786 and completion of 50% of the course of studies.

**PHED-799. Thesis**

An in-depth research project in the area of physical education. Each student will have an advisor and Thesis Committee, in accordance with the procedures within the Graduate School, who will provide guidelines in the completion of the study. Each student will present his/her findings and will provide a successful defense before the Thesis Committee.

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## History

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The Master of Science program builds upon the knowledge and skills already mastered by teachers at the undergraduate level. The required 15 hours of advanced professional core courses and the 24 hours of courses in the content area provide opportunities for teachers to advance their knowledge of pedagogy and content. Courses in content and the professional education core are designed to connect with and enhance what teachers are actually doing in their classrooms. The role, use, integration, and application of technology in the planning and teaching process are also emphasized. The major goal is to produce social studies educators, teachers, leaders, and scholars, who are catalysts for learning.

### DEGREE OFFERED

History Education - Master of Science

### GENERAL PROGRAM REQUIREMENTS

In addition to the general requirements specified in the description of the degree program in Education, a student wishing to be accepted as a candidate for the degree of Master of Science in Education with a concentration in History must hold or be qualified to hold a Class A teaching certificate in History or Social Studies. If a person does not qualify for certification, appropriate undergraduate or graduate courses may be taken to correct this deficiency.

### CAREER OPPORTUNITIES

The skills and knowledge learned in history and social science courses can lead to careers in education, journalism, business, archives and museums, international affairs, and government service, among others. The M.S. Degree Program in History Education prepares students for classroom teaching in secondary schools. Businesses also find that teacher education graduates make good human relations specialists, personnel directors, technical writers, sales managers, directors of training programs, and administrators.

### DEPARTMENTAL REQUIREMENTS

To complete the requirements for the degree of Master of Science in Education with a concentration in History, the student may elect the thesis option or the non-thesis option. A comprehensive examination is required in History as well as in Education. Students must maintain a grade point average of 3.0.

### PROGRAM OF STUDY

#### Required History Content Area Courses 24 hours

HIST 735 Historiography (3)

HIST 610 Seminar in the History of Twentieth Century Technology (3)

HIST 730 Seminar in History (3)

- HIST (United States History) (3)
- HIST (European History) (3)
- HIST (Courses/Non-Western History/minorities) (6)
- Social Science Elective (Non-Thesis Option) (3)
- HIST 750 Thesis in History (Thesis Option) (3)

### **Professional Education Core Courses 15 hours**

- 1. CUIIN 619 Learning Theories (3)
- 2. CUIIN 712 Advanced Methods (3)
- 3. CUIIN 729 Diversity Issues in K-12 Public Schools (3)
- 4. CUIIN 711 Methods and Techniques of Research (3)
- 5. CUIIN 728 Integrating Technology into the K-12 Curriculum (3)

### **OTHER REQUIREMENTS**

- 1. Research Project or Thesis
- 2. Performance-Based Portfolio
- 3. Comprehensive Examination

### **PROGRAM OBJECTIVES OF THE MASTER OF SCIENCE IN EDUCATION WITH A CONCENTRATION IN HISTORY**

Students in the M.S. degree program in History Education are provided the opportunity to:

- 1. Acquire advanced knowledge of pedagogical and thematic subject matter standards of the social studies curriculum.
- 2. Acquire advanced knowledge of major historiographical schools of thought and significant periods of history.
- 3. Become more aware of the contributions of historical and social science research to policy analysis and decision making.
- 4. Understand how students differ in their approaches to learning and be able to create teaching and learning strategies that address the needs of diverse learners.
- 5. Understand the impact of various groups, institutions, and nations on global history and development.
- 6. Improve performance and practice through self-evaluation, reflection, and applied research.
- 7. Understand how to select appropriate objectives consistent with state and local curriculum guide lines, the learning needs of students, and the standards established by the National Council of Social Studies and Interstate New Teacher Assessment and Support Consortium (INTASC).
- 8. To demonstrate instructional leadership as an individual and collaboratively.

### **History Courses**

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|----------|--|
| HIST 600 | The British Colonies and the American Revolution       |
| HIST 603 | Civil War and Reconstruction                           |
| HIST 605 | Twentieth Century Russian History                      |
| HIST 606 | United States History, 1900-1932                       |
| HIST 607 | United States History, 1932-Present                    |
| HIST 610 | Seminar in the History of Twentieth Century Technology |
| HIST 615 | Seminar in African-American History                    |
| HIST 616 | Seminar in African History                             |

HIST 617	Readings in African History
HIST 618	The African Diaspora
HIST 620	Seminar in Asian History
HIST 621	Seminar in Latin American and Caribbean History
HIST 626	Revolutions in the Modern World
HIST 628	The Civil Rights Movement
HIST 629	Seminar on the History of Early Modern Europe
HIST 630	Seminar in European History, 1815-1914
HIST 631	Studies in Twentieth Century Europe, 1914 to the Present
HIST 633	Independent Study in History
HIST 701	Recent United States Diplomatic History
HIST 712	Twentieth Century African-American History
HIST 730	Seminar in History
HIST 735	Historiography
HIST 740	History, Social Science, and Contemporary World Problems
HIST 750	Thesis in History

### **Geography Courses**

GEOG 640	Topics in Geography of the United States and Canada
GEOG 641	Topics in World Geography

## **COURSE DESCRIPTIONS FOR HISTORY**

### **HIST-600. The British Colonies and the American Revolution      Credit 3 (3-0)**

The planting and maturation of the English colonies of North America. Relationships between Europeans, Indians, and transplanted Africans, constitutional development, religious ferment, and the colonial economy are studied.

### **HIST-603. Civil War and Reconstruction      Credit 3 (3-0)**

Causes as well as constitutional and diplomatic aspects of the Civil War, the role of the African-American in slavery, in war, and in freedom; and the socio-economic and political aspects of Congressional Reconstruction and the emergence of the New South are studied.

### **HIST-605. Twentieth Century Russian History      Credit 3 (3-0)**

This is a reading, research, and discussion course that examines history of Twentieth century Russia with special emphasis on the Russian Revolution, the development of Communist society, the impact and legacy of Stalin, relations with the United States and other countries during the Cold War, the demise of the Soviet Union, and current problems facing post-Soviet Russia.

### **HIST-606. U.S. History, 1900-1932      Credit 3 (3-0)**

Emphasizes political, economic, social, cultural and diplomatic developments from 1900 to 1932 with special attention to their effect upon the people of the United States and their influence on the changing role of the U.S. in world affairs.

### **HIST-607. U.S. Since 1932-Present      Credit 3 (3-0)**

With special emphasis on the Great Depression, New Deal, the Great Society, and the expanding role of the United States as a world power, World War II, Cold War, Korean and Vietnam conflicts are studied. Major themes include the origin, consolidation, and expansion of the New Deal, the growth of executive power, the origins and spread of the Cold war, civil lib-



erties, and civil rights, and challenges for the extension of political and economic equality and the protection of the environment.

**HIST-610. Seminar in the History of Twentieth Century Technology** **Credit 3 (3-0)**

A reading, research, and discussion that investigates the development and, especially, the impact of major Twentieth century technologies. Attention will also be given to the process of invention, the relationship between science and technology, and the ethical problems associated with some contemporary technologies.

**HIST-615. Seminar in African-American History** **Credit 3 (3-0)**

This is a reading, research, and discussion course that concentrates on various aspects of the life and history of African-Americans. The emphasis is placed on historiography and major themes including nationalism, black leadership and ideologies, and economic development.

**HIST-616. Seminar in African History** **Credit 3 (3-0)**

Research, writing, and discussion on selected topics in African history.

**HIST-617. Readings in African History** **Credit 3 (3-0)**  
*(By arrangement with instructor.)*

**HIST-618. The African Diaspora** **Credit 3 (3-0)**

This is an advanced reading, research, and discussion course on the historical experience of people of African descent in a global context. It examines the worldwide dispersal and displacement of Africans over time, emphasizing their migration and settlement abroad over the past five centuries.

**HIST-620. Seminar in Asian History** **Credit 3 (3-0)**

Research, writing, and selected topics in Asian history.

**HIST-621. Seminar in Latin American and Caribbean History** **Credit 3 (3-0)**

This course requires research, writing, and discussion of selected topics in Latin American and Caribbean History including, urban and rural conflicts, social revolution, race relations, problems of underdevelopment, and contemporary issues.

**HIST-626. Revolutions in the Modern World** **Credit 3 (3-0)**

A seminar course stressing comparative analysis of revolutions and revolutionary movements in the United States, France, Russia, China, Cuba, and Iran. Students will also evaluate theories of revolution in light of historical examples.

**HIST-628. The Civil Rights Movement** **Credit 3 (3-0)**

From original research, class lectures, and discussions, students will become familiar with the nature of the Civil Rights Movement; will evaluate its successes and failures; and will analyze the goals and tactics of each major participating Civil Rights organization. Students will also evaluate the impact of the Civil Rights Movement on American society.

**HIST-629. Seminar on the History of Early Modern Europe** **Credit 3 (3-0)**

Through extensive readings, discussion, research, and writing, students will examine selected topics of enduring importance in the history of Europe from the Renaissance through the French Revolution.

**HIST-630. Studies in European History, 1815-1914** **Credit 3 (3-0)**

Intensive study of selected topics in Nineteenth Century European history.

**HIST-631. Studies in Twentieth Century Europe, 1914-Present** **Credit 3 (3-0)**

This course offers an intensive study of key topics in Twentieth century European history, including World Wars I and II, the Russian Revolution, Hitler and the Holocaust, the Depression,

the Cold War and bipolarism, the Welfare State, the Common Market, the collapse of Communism in Eastern Europe, and current problems.

**HIST-633. Independent Study in History**

**Credit 3 (3-0)**

*(By arrangement with instructor.)*

**HIST-701. Recent United States Diplomatic History**

**Credit 3 (3-0)**

Episodes in the history of American foreign relations that were especially important in influencing persistent patterns of this nation's role in international relations. Possible examples studied: Pearl Harbor, the Cold War, Korean War, Cuban missile crisis, Vietnam, nuclear arms limitation, and black Africa.

**HIST-712. Twentieth Century African-American History**

**Credit 3 (3-0)**

This course involves research, reading, discussion, and analysis of major facets of African-American life in the United States from 1900 to the present. It requires a major research paper.

**HIST-730. Seminar in History**

**Credit 3 (3-0)**

Topics to be selected by students and instructor. Includes a major research project.

**HIST-735. Historiography**

**Credit 3 (3-0)**

This course will examine historians and their philosophical and methodological approaches to the study of history and recent developments in analysis and theory. Overviews of the fundamental issues and debates in the fields of history will be discussed. Basic computer skills will also be emphasized.

**HIST-740. History, Social Science, and Contemporary**

**World Problems Credit 3 (3-0)**

Readings, discussions, and reports on the relationships between history and the social sciences as a whole, as well as their combined roles in dealing with contemporary world problems.

**HIST-750. Thesis in History**

**Credit 3 (3-0)**

Thesis work will be done with the appropriate instructor in accordance with field of interest.

**CUIN-725. Problems and Trends in Teaching the Social**

**Sciences**

**Credit 3 (3-0)**

Current strategies, methods, and materials for teaching the social sciences. Emphasis on innovations, evaluation and relation to learning. Provision for clinical experiences.

**COURSE DESCRIPTIONS FOR GEOGRAPHY**

**GEOG-640. Topics in Geography of the United States  
and Canada**

**Credit 3 (3-0)**

Selected topics in cultural geography of the United States and Canada are studied intensively. Emphasis is placed upon individual reading and research and upon group discussion.

**GEOG-641. Topics in World Geography**

**Credit 3 (3-0)**

Selected topics in geography are studied intensively. Concern is for cultural characteristics and their interrelationships with each other and with the habitat. Emphasis is upon reading, research, and discussion.

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## Human Development Services

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Wyatt D. Kirk, Chairperson  
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### OBJECTIVES

The objectives of the Department of Human Development and Services are to prepare individuals for professional roles in Adult Education and Counseling. Departmental studies include philosophical, theoretical, and methodological foundations for adult educational and counseling practices, practical examination of human development and learning through the life span, and supervised experience in practice settings.

Departmental graduates pursue professional careers within a diversity of human services settings, including schools, post-secondary and higher education, public and private counseling centers, community education and development, services administration, corrections, human resource development/training, health education, and university extension programs.

Although many participants are enrolled in full-time graduate study, the Department welcomes practicing professionals who choose to pursue their studies on a part-time basis. Course work in the Department is generally offered in the evenings to accommodate the professional development needs of practicing adult educators and counselors.

### DEGREES OFFERED

Master of Science Degree in Adult Education  
Master of Science Degree in Counselor Education  
Master of Science Degree in Human Resources (Business and Industry)  
Master of Science Degree in Human Resources (Community/Agency)

### GENERAL PROGRAM REQUIREMENTS

Persons applying for graduate study in the Department of Human Development and Services at North Carolina A&T State University must obtain an application for admittance from the School of Graduate Studies. Prospective students must complete and forward the application including submission of three letters of recommendation to the Graduate School.

The applicant's packet will be reviewed by the Graduate School and the admissions committee of the Department of Human Development and Services. Applicants may be requested to participate in a pre-admissions interview with departmental faculty. The admissions decision at the department level is based on the recommendation of the admissions committee, other departmental faculty, and the Chairperson.

Persons applying for graduate study within Departmental Programs should have an overall undergraduate GPA of 3.0 or higher on a 4 point system. Primary factors in the admissions decision include academic background, demonstrated professional and volunteer experience appropriate to Departmental programs of study, letters of recommendation or reference forms, official transcripts of all prior academic work, and Graduate Record Examination (GRE) scores. Test of English as a Foreign Language is required for international students. Applicants who do not meet minimum GPA requirements may be admitted to Departmental programs on the weight of other factors.

Persons applying for graduate study in counseling may be asked to take the Graduate Record Examination (GRE) and have these scores submitted to the graduate school as a part of the application process, if asked to do so by the departmental admissions committee. GRE scores will be considered in the overall admissions decision. The GRE requirement does not apply to adult education master's candidates.

Applicants for graduate study in Adult Education who have creditable professional and/or volunteer experience in adult education practice are encouraged to submit a brief portfolio in addition to, and in support of, the resume. The portfolio would include samples of original work (i.e. workshops, presentations, publications) from employment or volunteer experience (i.e. voluntary organizations, church). The portfolio will be considered in the overall admissions decision as evidence of applicable professional and volunteer experience.

For a complete copy of the admissions policy, contact the department office. The employer letter of reference, current resume, and professional portfolio should be submitted to:

North Carolina A&T State University  
School of Graduate Studies  
ATTN: Admissions  
120 Gibbs Hall  
Greensboro, NC 27411

## DEPARTMENT REQUIREMENTS

**Adult Education** majors must successfully complete a minimum of 36 credit hours of approved graduate study. The program of study is composed of a professional core curriculum consisting of 21 graduate semester hours, including a faculty supervised practicum experience, and a minimum of 15 semester hours in a research or practice concentration. The concentration entails graduate research and cognate studies in an adult education specialty (thesis option) or an adult education practice concentration (non-thesis option). The concentration (thesis or non-thesis) is determined by the participant in collaboration with his or her faculty advisor and is subject to approval by the Department Chair. Practice concentrations are currently designated in Community Education, Counseling, Higher Education, Human Resource Development, and Instructional Technology.

As a culminating experience, the Research Concentration (Thesis Option) participant must research and write a masters' thesis in the field of adult education under the supervision of his/her major advisor, and defend it before a departmental Thesis Research Committee. Practice Concentration (Non-Thesis Option) participants must complete a four-hour master's comprehensive examination administered by the Department. Students will not be allowed to take the Counseling Comprehensive Examination unless all professional core courses have been taken excluding HDSV 765, 780 and 790. In addition to serving Departmental master's candidates, students enrolled in master's programs other than Adult Education, as well as holders of master's degrees who are not currently engaged in graduate study, may enroll, with administrative approval, in Adult Education professional core courses or concentrations to augment their studies and professional development.

**Counseling** majors must complete 60 hours of graduate work. The program of study is composed of a professional core curriculum consisting of 48 graduate semester hours, including a faculty supervised practicum experience and two 300 hour internships, in addition to a minimum of 12 semester hours of electives. The electives allow graduate students the opportunity to develop specialties in the counseling profession.

There are three tracks as options in the counseling curriculum. The Community/Agency Counseling track prepares students for a variety of counseling careers in the public and private



sector, including post-secondary education settings. The Human Resources Counseling track prepares students for counseling-related positions in business and industry. The School Counseling track prepares students for counseling positions in elementary, middle, and high schools.

**PROGRAM OF STUDY FOR THE M.S. IN ADULT EDUCATION**

<b>Professional Core (21 credit hours)</b>		<b>Credits</b>
ADED 707	Foundations of Adult Education	3
ADED 708	Methods in Adult Education	3
ADED 709	Adult Development and Learning	3
ADED 700	History and Philosophy of Adult and Continuing Education	3
ADED 701	Organization, Administration, & Supervision of Adult Education Programs	3
HDSV 630	Statistics and Research Methodology	3
ADED 702	Practicum and Seminar in Adult Education (50 contact hours or more)	3
<i>Prerequisites: completion of 21 credit hours including 15 hours of professional core courses, or permission of the instructor.</i>		

<b>Concentration (15 hours minimum)</b>		<b>Credits</b>
<b>Research Concentration (Thesis Track)</b>		
HDSV 707	Applied Research or;	3
	Comparable Research Design Course	3
ADED 705	Thesis Research in Adult Education	6
	Approved Electives	6
<i>In lieu of taking the master's comprehensive examination, thesis students will defend their completed research before their respective faculty advisory committees.</i>		

<b>Practice Concentration (Non-Thesis Track)</b>		
	<i>Electives to comprise a practice concentration</i>	15
<i>In consultation with his/her advisor, the student may elect to pursue a designated practice concentration (below), or develop a unique concentration from among university-wide course offerings that is tailored to his/her career interests and goals.</i>		

## PRACTICE CONCENTRATIONS

### Adult Education

In consultation with their advisors, non-thesis students individually develop practice concentrations within adult education.

#### Recommended Courses for Practice Concentrations

##### *Community Education*

		<b>Credits</b>
ADED 771	Program Development in Community Education	3
ADED 772	Program Management in Community Education	3
ADED 711	Gerontology	3
ADED 712	Developmental Adult Education	3
	One Approved Elective	3

##### *Higher Education*

ADED 776	Principles of College Teaching	3
ADED 714	The Community College	3
ADED 778	Student Personnel Services	3
ADED 773	Leadership	3
	One Approved Elective	3

##### *Human Resource Development*

ADED 710	Foundations of Human Resource Development	3
CUIN 612	Instructional Design	3
CUIN 714	Instructional Technology Services for Business and Industry	3
GCT 670	Introduction to Workplace Training and Development	3
GCT 671	Methods and Techniques of Workplace Training and Development	3

##### *Instructional Technology*

CUIN 612	Instructional Design	3
CUIN 617	Computers in Education	3
CUIN 712	Advanced Internet Uses in Education	3
CUIN 740	Distance Education	3
	One Elective Below:	
CUIN 714	Instructional Technology Services for Business and Industry	3
CUIN 716	Multimedia Development and Evaluation	3
CUIN 741	Educational Software Evaluation and Design	3
CUIN 742	Authoring Software	3

#### Course Offerings in Adult Education

ADED 700	History and Philosophy of Adult and Continuing Education	3 (3-0)
ADED 701	Organization, Administration and Supervision of Adult/Continuing Education Programs	3 (3-0)
ADED 702	Practicum and Seminar in Adult Education	3 (1-4)
ADED 703	Seminar on Contemporary Issues in Adult Continuing Education	3 (3-0)
ADED 704	Independent Study	3 (3-0)
ADED 705	Thesis Research in Adult Education	6 (6-0)
ADED 706	Special Problems in Adult Education	3 (3-0)
ADED 707	Foundations of Adult Education	3 (3-0)

ADED 708	Methods in Adult Education	3 (3-0)
ADED 709	Adult Development and Learning	3 (3-0)
ADED 710	Foundations of Human Resource Development	3 (3-0)
ADED 711	Social Gerontology	3 (3-0)
ADED 712	Developmental Adult Education	3 (3-0)
ADED 713	Literacy in the Black Diaspora	3 (3-0)
ADED 714	The Community College and Postsecondary Education	3 (3-0)
ADED 715	Women in Adult Education	3 (3-0)
ADED 716	Qualitative Research in Adult Education and Continuing Education	3 (3-0)
ADED 759	Computer Applications in Adult Education	3 (3-0)
ADED 771	Program Development: Community Education	3 (3-0)
ADED 772	Program Management: Community Education	3 (3-0)
ADED 773	Leadership	3 (3-0)
ADED 774	The Changing Environment of Human Resources Development	3 (3-0)
ADED 775	Learning Interventions for Human Resources Development	3 (3-0)
ADED 776	Principles of College Teaching	3 (3-0)
ADED 777	Seminar in Higher Education	3 (3-0)
ADED 778	Student Personnel Services	3 (3-0)
ADED 779	Technical Education in Community Junior Colleges	3 (3-0)
ADED 785A	Independent Readings in Education I	1 (0-2)
ADED 786A	Independent Readings in Education II	2 (0-4)
ADED 787A	Independent Readings in Education III	3 (0-6)
ADED 790A	Seminar in Education Problems	3 (3-0)

## **COURSE DESCRIPTIONS IN ADULT EDUCATION**

### **ADED-700. History and Philosophy of Adult and Continuing Education**

**Credit 3 (3-0)**

This is a study of historical and philosophical foundations and thought utilized in the analysis of adult education teaching and learning. The evolution of adult education as a discipline is studied from a multicultural perspective.

### **ADED-701. Organization, Administration and Supervision of Adult/Continuing Education Programs**

**Credit 3 (3-0)**

This course is an examination of theories, concepts and practices as they relate to administrative time functions: planning, organizing, staffing, financing, motivating, decision-making, evaluating and delegating in an Adult Education organization.

### **ADED-702. Practicum and Seminar in Adult Education**

**Credit 3 (1-4)**

This course engages participants in a supervised field experience with an agency, business, institution or organization, to enable praxis of adult education theory and methodology. The seminar provides for shared reflection, integration, and discussion of theoretical, methodological implementation and experiences. The practicum experience consists of (50) clock hours. This course is graded as a pass/fail. Prerequisites: Twenty-one (21) graduate credit hours including 18 hours of professional core courses, or permission of instructor.

### **ADED-703. Seminar on Contemporary Issues in Adult Continuing Education**

**Credit 3 (3-0)**

This course is integrative in nature, thereby offering the student an opportunity to synthesize concepts, theories, and methods of teaching adults.

**ADED-704. Independent Study****Credit 3 (3-0)**

This course permits a participant to develop and execute a learning contract with the instructor to analyze a problem in adult education through supervised study, outside the classroom setting. The problem may be selected from the scholarly literature of adult education or the professional workplace. Prerequisites: Permission of the instructor.

**ADED-705. Thesis Research in Adult Education****Credit 6 (6-0)**

Original graduate level research in adult education is carried out by the adult learner under the supervision of the thesis research committee chairperson and leading to completion of the Master's Thesis. This course is available only to thesis option participants. This course is graded as pass/fail. Prerequisites: Thirty (30) graduate credit hours including ADED 716 or HDSV 770 or comparable research design course, or permission of the instructor.

**ADED-706. Special Problems in Adult Education****Credit 3 (3-0)**

Special topics, individual and group study projects, research, workshops, seminars, travel study tours and organized visitations in areas of adult education planned and agreed upon by participating students may be included in this course.

**ADED-707. Foundations of Adult Education****Credit 3 (3-0)**

This course will introduce and address the philosophical, sociological and psychological foundations of adult education, and develop a view of the subject as a broad, diverse, and complex field of study, research, and professional practice. Students will survey many institutions, programs, and individual activities. The range of methods and materials used to enable adults to learn will be discussed.

**ADED-708. Methods in Adult Education****Credit 3 (3-0)**

This course addresses adult education methodology and learning in formal, non-formal, and informal settings. Attention is given to adult education philosophical perspectives and teaching styles and their implications for methodology.

**ADED-709. Adult Development and Learning****Credit 3 (3-0)**

The social and psychological contexts of learning, motivation and educational participation will be examined. Major theories of adult development and learning, and their implications for professional practice will be explored through readings, small group and whole class discussion, and inquiry team projects. This course is appropriate for any educators and human services professionals who work with adults including college, university, and other post-secondary educators and counselors, adult secondary educators, community services providers, trainers and human resource developers.

**ADED-710. Foundations of Human Resource Development****Credit 3 (3-0)**

Human Resource Development (HRD) is concerned with the human resources within both public and private sector organizations, and is defined as the integrated use of employee training and development, organization development, and career development, to improve individual, group, and organizational effectiveness in attaining strategic goals and objectives. This course addresses concepts, practices, and issues in HRD with a focus on workplace learning organizational analysis.

**ADED-711. Social Gerontology****Credit 3 (3-0)**

This is the study of cultural, sociological and economic factors affecting older adults and their implications for adult education practice.



**ADED-712. Developmental Adult Education** **Credit 3 (3-0)**

This course surveys the complex and growing field of developmental adult education and will include topics relevant to collegiate remedial education, adult literacy, basic and secondary education. English as a second language, and working with the learning disabled adult.

**ADED-714. The Community College and Postsecondary Education** **Credit 3 (3-0)**

This is a study of the purposes, organization, functions, current trends and historical evolution of the comprehensive community college, and its role within adult, community and higher education. The North Carolina Community College System is emphasized.

**ADED-759. Computer Applications in Adult Education** **Credit 3 (3-0)**

Experiences will be provided in various computer and software application for adult and higher education.

**ADED-771. Program Development: Community Education** **Credit 3 (3-0)**

This course is a study of community needs assessment, community program design, program budgeting, grant writing, planning, and infusion of education that is multicultural into the community education curriculum.

**ADED-772. Program Management: Community Education** **Credit 3 (3-0)**

This course is the study of organization and governance of community education, program implementation, direction, supervision and evaluation.

**ADED-773. Leadership** **Credit 3 (3-0)**

This course introduces the adult learner to leadership theories, styles, ethics, values, principals, and perspectives. Case studies and other methods are used to examine leadership situations as a means of demonstrating and exercising practical applications of the concepts studied.

**ADED-776. Principles of College Teaching** **Credit 3 (3-0)**

This course uses an exploratory approach to the framework and mechanics required to teach successfully at the college level. It addresses skills, methods, course development and syllabus design, the evaluation of learning, diversity appreciation, creativity and the integration of technology, and trends in distance education.

**ADED-777. Seminar in Higher Education** **Credit 3 (3-0)**

This course is a synthesis of current research in higher education relating to administration, curriculum, and faculty development.

**ADED-778. Student Personnel Services** **Credit 3 (3-0)**

This course is an analysis of student development programs in post-secondary institutions, including pre-admission; education; vocational and personal counseling; career guidance services; attitude and interest assessment; student affairs, rights, and responsibilities and financial aid.

**ADED-779. Technical Education in Community Junior Colleges** **Credit 3 (3-0)**

This course offers techniques in identifying community needs and in planning curricula and courses for technical/vocational education.

**ADED-785A. Independent Readings in Education I** **Credit 1 (0-2)**

This course includes individual study and selected readings in consultation with an instructor. Prerequisites: 24 hours of graduate credit.

**ADED-786A. Independent Readings in Education II** **Credit 2 (0-4)**

This course involves individual study and selected readings in consultation with an instructor. Prerequisites: 24 hours of graduate credit.

**ADED-787A. Independent Readings in Education III****Credit 3 (0-6)**

This course involves individual study and selected readings in consultation with an instructor.

Prerequisites: 24 hours of graduate credit.

**ADED-790A. Seminar in Education Problems****Credit 3 (3-0)**

This course includes intensive study, investigation, or research in selected areas of adult education. Prerequisites: 24 hours graduate credits.

**Program of Study for the M.S.  
in Human Resources (Business and Industry)**

		<b>Credit Hours</b>
HDSV 602	Human Development	3
HDSV 610	Counseling Services	3
HDSV 630	Statistics and Research Methodology	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 711	Human Resources Counseling	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 736	Multicultural Counseling	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 759	Substance Abuse Counseling	3
HDSV 760	Career Counseling (Lab)	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	Electives	12
<b>Total</b>		<b>60 Hours</b>

**Program of Study for the M.S.  
in School Counseling**

		<b>Credit Hours</b>
HDSV 602	Human Development	3
HDSV 610	Counseling Services	3
HDSV 630	Statistics and Research Methodology	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 706	Organization and Administration of Counseling Programs	3
HDSV 712	Counseling School Age Children	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 760	Career Counseling (Lab)	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	Electives	12
<b>Total</b>		<b>60 Hours</b>

**Program of Study for the M.S.  
in Human Resources (Community/Agency)**

		<b>Credit Hours</b>
HDSV 602	Human Development	3
HDSV 610	Counseling Services	3
HDSV 630	Statistics and Research Methodology	3
HDSV 640	Professional Orientation and Ethics in Counseling	3
HDSV 650	Theories of Counseling	3
HDSV 710	Community/Agency Counseling	3
HDSV 735	Counseling Methods (Lab)	3
HDSV 736	Multicultural Counseling	3
HDSV 740	Appraisal	3
HDSV 750	Group Counseling (Lab)	3
HDSV 760	Career Counseling (Lab)	3
HDSV 763	Family Counseling (Lab)	3
HDSV 765	Practicum (Lab)	3
HDSV 770	Applied Research in Counseling	3
HDSV 780	Internship I	3
HDSV 790	Internship II	3
	Electives	12
<b>Total</b>		<b>60 Hours</b>

**Course Offerings in Counseling**

		<b>Credit</b>
HDSV 602	Human Development	3 (3-0)
HDSV 610	Counseling Services	3 (3-0)
HDSV 630	Statistics and Research Methodology	3 (3-0)
HDSV 640	Professional Orientation and Ethics in Counseling	3 (3-0)
HDSV 650	Theories of Counseling	3 (3-0)
HDSV 706	Organization and Administration of School Counseling Programs	3 (3-0)
HDSV 711	Human Resource Counseling	3 (3-0)
HDSV 712	Counseling School Age Children	3 (3-0)
HDSV 721	Independent Study	3 (3-0)
HDSV 735	Counseling Methods (Lab)	3 (3-0)
HDSV 736	Multicultural Counseling	3 (3-0)
HDSV 739	Community/Agency Counseling	3 (3-0)
HDSV 740	Appraisal	3 (3-0)
HDSV 750	Group Counseling (Lab)	3 (3-0)
HDSV 751	Special Topics in Counseling	3 (3-0)
HDSV 759	Substance Abuse Counseling	3 (3-0)
HDSV 760	Career Counseling (Lab)	3 (3-0)
HDSV 763	Family Counseling (Lab)	3 (3-0)
HDSV 765	Practicum (Lab)	3 (1-4)
HDSV 770	Applied Research in Counseling	3 (2-2)
HDSV 780	Internship I	3 (0-6)
HDSV 790	Internship II	3 (0-6)

## COURSE DESCRIPTIONS IN COUNSELING

### **HDSV-602. Human Development**

**Credit 3 (3-0)**

This course is an examination of human psychological development through the life span.

### **HDSV-610. Counseling Services**

**Credit 3 (3-0)**

Those aspects of counseling as they apply to school, community, and business settings will be covered in this course.

### **HDSV-630. Statistics and Research Methodology**

**Credit 3 (3-0)**

Basic statistical methods and the tools of research make up the content of this course.

### **HDSV-640. Professional Orientation and Ethics in Counseling**

**Credit 3 (3-0)**

Ethics, standards, and credentialing for professional counselors are presented in this course.

### **HDSV-650. Theories of Counseling**

**Credit 3 (3-0)**

This course is an introduction to the primary theories and techniques in the field of counseling and their underlying components. Prerequisites: HDSV 602, 610.

### **HDSV-706. Organization and Administration of School Counseling Programs**

**Credit 3 (3-0)**

This course is a study of the organization and implementation of guidance services in schools. Prerequisite: HDSV 610.

### **HDSV-711. Human Resource Counseling**

**Credit 3 (3-0)**

This course provides the emerging trends in human resources with an emphasis on counseling, coordinating, and consulting. Prerequisite: HDSV 650.

### **HDSV-712. Counseling School Age Children**

**Credit 3 (3-0)**

This course examines how counselors can be effective in addressing the developmental, mental, and psychological needs of elementary, middle, and high school students. Prerequisite: HDSV 650.

### **HDSV-721. Independent Study**

**Credit 3 (3-0)**

With the supervision of an approving professor, a student may carry out a special project of particular interest, and with appropriate relationship to his counseling specialization. Students must apply for and obtain approval of the supervising professor and the department chairperson one semester before registering for this course. The work of the course must be submitted in the form of a written report.

### **HDSV-735. Counseling Methods**

**Credit 3 (3-0)**

The fundamentals of general counseling skills will be addressed as a foundation for further study. This course includes laboratory experiences for the observation and application of counseling skills. Prerequisite: HDSV 650.

### **HDSV-736. Multicultural Counseling**

**Credit 3 (3-0)**

This course provides an overview of issues and trends for counselors in a diverse society. Prerequisites: HDSV 650, 735.

### **HDSV 739. Community/Agency Counseling**

**Credit 3 (3-0)**

Counseling delivery systems and procedures found in community/agency settings will be examined in this course. Prerequisite: HDSV 735.

### **HDSV-740. Appraisal**

**Credit 3 (3-0)**

The student will be introduced to evaluation and assessment tools, including relevant statistics and computer applications. Prerequisite: HDSV 630.



**HDSV-750. Group Counseling****Credit 3 (3-0)**

Theories, techniques, and procedures appropriate for counseling groups will be included, as well as topics to build understanding of group development and dynamics. This course includes laboratory experiences for observation and application of group counseling skills. Prerequisite: HDSV 650.

**HDSV-751. Special Topics in Counseling****Credit 3 (3-0)**

Topics in various areas of counseling will be selected and announced by the professor. Prerequisite: HDSV 735.

**HDSV-759. Substance Abuse Counseling****Credit 3 (3-0)**

This course will examine the impact of chemical dependency and abuse on the development of individuals, the functioning of families and the productivity of the workforce. Comprehensive ways of conceptualizing and treating substance abuse will be discussed. Prerequisites: HDSV 735, 736.

**HDSV-760. Career Counseling****Credit 3 (3-0)**

This course includes career development theories, applied and related counseling procedures and technological applications. This course includes laboratory experiences for observation of and practice in career counseling. Prerequisite: HDSV 735.

**HDSV-763. Family Counseling****Credit 3 (3-0)**

This course will introduce major theories of family counseling, including family systems therapy. Experiential, structural, and functional techniques of family counseling and assessment will be addressed. Prerequisite: HDSV 735.

**HDSV-765. Practicum****Credit 3 (1-4)**

This is a laboratory course in which studies will engage in supervised practice in the use of counseling skills. Prerequisites: HDSV 735 and 750.

**HDSV-770. Applied Research****Credit 3 (2-2)**

A research report of a technical nature must be produced using skills acquired in HDSV 630. The written report will be under the supervision of the instructor. A technical oral presentation will be required. Prerequisite: HDSV 740.

**HDSV-780. Internship I****Credit 3 (0-6)**

This course requires three hundred (300) clock hours of supervised internship in an appropriate field placement. Students must apply to take this course one semester before enrollment and after all prior\* professional courses have been completed. Class meetings will be scheduled and announced by the professor. Individual conferences will be required.

**HDSV-790. Internship II****Credit 3 (0-6)**

Three hundred (300) clock hours of advanced supervised practice in an appropriate counseling setting is required. Students must apply to take this course one semester before placement. Class meetings will be scheduled and announced by the professor. Individual conferences will be required.

*\*Exceptions: Prior professional courses except HDSV 759, 763, and 770*

*HDSV 765 and 780 may be taken concurrently*

*All major courses must be taken in the counseling program here at NORTH CAROLINA A&T State University. All "provisionally admitted" students must be reviewed after 9 hours of coursework and see their advisors for additional courses.*

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## Human Environment and Family Sciences

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Thurman Guy, Interim Chairperson  
102 Benbow Hall  
(336) 334-7850  
thurmang@ncat.edu

### OBJECTIVES

The objectives of the graduate program in Food and Nutrition are:

1. To develop the basic knowledge and skills necessary to undertake research in the Food and Nutritional Sciences and other related areas.
2. To develop competencies to work as nutrition specialists in education, or with other community nutrition agencies and food industries.
3. To obtain theoretical and experimental competencies necessary to pursue additional graduate studies or obtain professional degrees.

### DEGREE OFFERED

Food and Nutrition - Master of Science

### GENERAL PROGRAM REQUIREMENTS

For admission, students in the graduate program in Food and Nutrition must have an earned baccalaureate degree in Food and Nutrition from an accredited undergraduate institution and have an overall grade point average of 2.6. Non-food and nutrition majors are encouraged to apply but students are required to clear the course deficiencies after enrolled. A minimum of six (6) hours or more of Food and Nutrition courses is required to clear these deficiencies. TOEFL (foreign students) is required. The Graduate Record Examination is not required for admission into the program.

Option A is concerned with advanced training in Human Nutrition and Food Science. Each student is required to submit a thesis based on experimental work related to Nutrition or Food Science. Applicants who have majored in Food and Nutrition, Food Science, Chemistry, Biochemistry, Biology, Animal and Plant Sciences, Physiology, or other related science disciplines will be admitted.

The Option B plan is a non-thesis program, which has flexibility for students to choose extra course work (minimum six (6) credit hours).

### OTHER REQUIREMENTS

All applicants are required to take a Qualifying Examination in Food and Nutrition to evaluate their strengths and weaknesses. The test must be taken preferably prior to the registration for graduate courses or at the latest by the end of the first semester of the graduate work. The student may take one basic Food Science course and one Nutrition course each, and make a grade of B or better in place of taking the qualifying examination. Admission to candidacy for the M.S. in Food and Nutrition requires the satisfactory completion of the Qualifying Examination in Food and Nutrition, maintain a minimum overall average of 3.0 in at least nine (9) semester hours of graduate work at A&T, and removal of all deficiencies in undergraduate preparation.

A final Comprehensive Examination in Food and Nutrition can be taken only if a student has completed all course work and maintained a 3.0 grade point average in the Graduate courses at the 600 level or above. At least fifty percent of the courses counted in the work towards the Master's degree must be those open only to graduate students.

The student must have already completed the Departmental Qualifying Examination, the Comprehensive Examination, satisfactory presentation and defense of the thesis (thesis option) and submission to the graduate office or completion of practicum (non-thesis) in order to be approved for graduation.

**CAREER OPPORTUNITIES**

A degree in this area prepares students to enter careers in research, quality control, college and junior college teaching, food industry, community nutrition, dietetics, extension service and public service.

For further information contact the Chairperson, Human Environment & Family Sciences, North Carolina A&T State University, Greensboro NC 27411.

**A. Suggested Curriculum Guide for Option A - Food and Nutrition      30 Credit Hours**  
Requirements:

- 1. Twelve (12) semester hours of Food and Nutrition courses.
  - HEFS 730 - Nutrition and Disease 3 credits
  - (prerequisite HEFS 630 - Advanced Nutrition)
  - HEFS 735 - Experimental Foods 4 credits
  - (prerequisite HEFS 236 - Introduction to Food Science)
  - or
  - HEFS 631 - Food Chemistry 3 credits
  - (prerequisite HEFS 236 - Introduction to Food Science)
  - HEFS 736 - Research Methods Food and Nutrition 4 credits
  - (prerequisite HEFS 635 - Introduction to Research Methods)
  - HEFS 744 - Seminar in Food and Nutrition 2 credits
- 2. In addition to the above core courses three (3) hours of statistics numbered 600 or above are required.
- 3. Six (6) semester hours in Food and Nutrition and related areas are required.
- 4. Three (3) semester hours of advanced Biochemistry or equivalent numbered 600 or above.
- 5. Three (3) semester hours of suggested electives.
- 6. HEFS 739 - Thesis Research 3 credits

**B. Suggested Curriculum Guide for Option B (Non-Thesis)      36 Credit Hours**  
Requirements:

- 1. Twelve (12) semester hours of Food and Nutrition courses.
  - HEFS 730 - Nutrition and Disease 3 credits
  - (prerequisite HEFS 630 - Advanced Nutrition)
  - HEFS 735 - Experimental Foods 4 credits
  - (prerequisite HEFS 236 - Introduction to Food Science)
  - or
  - HEFS 631 - Food Chemistry 3 credits
  - (prerequisite HEFS 236 - Introduction to Food Science)
  - HEFS 736 - Research Methods Food and Nutrition 4 credits
  - (prerequisite HEFS 635 - Introduction to Research Methods)

2. In addition to the above core courses three (3) hours of statistics numbered 600 or above are required.
3. Fifteen (15) semester hours in Food and Nutrition and related areas are required.
4. Three (3) semester hours of advanced Biochemistry numbered 600 or above or equivalent.
5. Three (3) semester hours of suggested electives.

### **COURSES - FOOD AND NUTRITION AND RELATED AREAS**

HEFS 601	Quantity Food
HEFS 630	Advanced Nutrition
HEFS 631	Food Chemistry
HEFS 632	Maternal and Developmental Nutrition
HEFS 635	Introduction to Research Methods in Food and Nutrition
HEFS 636	Food Promotion
HEFS 637	Special Problem in Food, Nutrition or Food Science
HEFS 638	Sensory Evaluation
HEFS 640	Geriatric Nutrition
HEFS 641	Current Trends in Food Service
HEFS 643	Food Preservation
HEFS 648	Community Nutrition
HEFS 650	International Nutrition
HEFS 651	Food Safety and Sanitation
HEFS 652	Diet Therapy
HEFS 679	Nutrition Education
HEFS 715	Trace Elements and Nutrition
HEFS 730	Nutrition and Disease
HEFS 733	Nutrition during the Growth and Development
HEFS 734	Nutrition Education
HEFS 735	Experimental Foods
HEFS 736	Research Methods in Food and Nutrition
HEFS 739	Thesis Research
HEFS 740	Community Nutrition
HEFS 742	Food Culture: Nutrition Anthropology
HEFS 744	Seminar in Food and Nutrition
HEFS 745	Practicum in Food and Nutrition

### **Suggested Elective Courses**

HEFS 606	Cooperative Extension
HEFS 607	Cooperative Extension Field Experience
HEFS 608	Teaching Adults and Youth in Out-of-School Settings
ANSC 615	Selection of Meat and Meat Products
ANSC 617	Physiology of Reproduction of Farm Animals
BIOL 630	Molecular Genetics
CHEM 651	General Biochemistry
COMP 600	Special Topics in Computer Science
CUIN 617	Computer in Education



SOCI 617	Research Methods II
EDLP 785	Independent Readings in Education I
EDLP 786	Independent Reading in Education III
EDLP 787	Independent Reading in Education III
EDLP 790	Seminar in Education Problem

## **COURSES WITH DESCRIPTION IN HUMAN ENVIRONMENT AND FAMILY SCIENCE**

### **Food and Nutrition**

#### **Advanced Undergraduate and Graduate Courses**

#### **HEFS-601. Quantity Foods Credit 4 (1-6)**

The application of principles of cookery to the preparation and service of food for group feeding with emphasis on menu planning, work schedules, cost and portion control, distribution and service are implemented in a laboratory setting. Prerequisites: HEFS-130, 246, 344, AGECE-446.

#### **HEFS-630. Advanced Nutrition Credit 3 (3-0)**

Intermediate metabolism and interrelationships of organic and inorganic food nutrients in human biochemical functions. Prerequisites: HEFS-337 and CHEM-251, 252 or equivalent.

#### **HEFS-631. Food Chemistry Credit 3 (2-2)**

A study of the chemical, biochemical and physical properties of components of basic raw foods and behavior of the components including non-microbial changes during processing and storage. Prerequisites: HEFS-236, CHEM-106, 107 and 251.

#### **HEFS-632. Maternal and Lifespan Nutrition Credit 3 (3-0)**

This course emphasizes the energy and nutrient requirements and feeding practices for stages of the life span. Influences of nutrition on growth and development are discussed. Nutritional quality of food, physiological development, growth assessment, dietary evaluation and nutrition assessment for various stages of the lifespan are covered. Prerequisites: HEFS-332, 337 or instructor's permission.

#### **HEFS-633. Food Analysis Credit 3 (1-4)**

Fundamental chemical, physical and sensory aspects of food composition as they relate to physical properties, acceptability and nutritional values of foods. Prerequisites: CHEM-102, 112, HEFS-236.

#### **HEFS-635. Introduction to Research Methods in Food and Nutrition Credit 3 (0-6)**

Laboratory experiences in the use of methods applicable to food and nutrition research. Prerequisite: Consent of the instructor.

#### **HEFS-636. Food Promotion Credit 4 (1-6)**

A course which gives experiences in the development and testing of recipes. Opportunities will be provided for demonstrations, writing and photography with selected business.

#### **HEFS-637. Special Problems in Food and Nutrition Credit 3 (0-6)**

Independent study and/or experiences in food and/or nutrition. Prerequisite: Admission by instructor.

#### **HEFS-638. Sensory Evaluation Credit 3 (2-2)**

A study of the color, flavor, aroma and texture of foods by the use of sensory evaluation methods. Prerequisites: HEFS-236, HEFS-337.

**HEFS-640. Geriatric Nutrition****Credit 3 (3-0)**

Multidisciplinary approaches to geriatric foods, nutrition and health problems. Evaluation of nutritional status and nutrition care of the elderly is emphasized. Field experience: nursing home and other community agencies. Prerequisite: HEFS-337 or 439.

**HEFS-641. Current Trends in Food Science****Credit 3 (3-0)**

Recent developments in food science and their implications for food scientists, nutritionists, dietitians and other professionals in the food industry and related professions.

**HEFS-643. Food Preservation****Credit 3 (2-2)**

A study of current methods of preserving foods - canning, freezing, dehydration, radiation, and fermentation. Prerequisite: HEFS-236 or equivalent.

**HEFS-645. Special Problems in Food Administration****Credit 2 (0-4)**

Individual work on special problems in food administration.

**HEFS-648. Community Nutrition****Credit 3 (3-0)**

This course provides an introduction and review of major communication and education skills that dietitians and nutritionists use in techniques of interviewing and counseling in community nutrition programs, and materials, methods and goals in planning, assessing, organizing and marketing nutrition for health promotion and preventing diseases. Evaluation of food and nutrition programs at State and Federal level are included. Prerequisite: HEFS-679.

**HEFS-650. International Nutrition****Credit 3 (3-0)**

An ecological approach to the hunger and malnutrition in technologically developed and developing countries. Focus on integrated intervention programs, projects, and problems. Opportunities to participate in national and international internships through cooperative arrangements.

**HEFS-651. Food Safety and Sanitation****Credit 3 (3-0)**

This course covers practices and procedures for hygienic food handling, processing, sanitation, food safety laws, and implementation of Hazard Analysis Critical Control point (HACCP) system in food processing and food service operations. Emphasis is placed on sanitation management, hazards, standards, and corrective actions for food service operations that are critical control points for food safety. Practical measures for prevention of food borne diseases and effects of microorganisms, toxins, foreign objectives and physical damage on the safety and quality of foods are discussed. Prerequisite: BIOL-220.

**HEFS-652. Diet Therapy****Credit 4 (3-2)**

This course is a study of the principles of nutritional sciences in the treatment and management of nutrition related diseases. Course content includes etiology, prevalence, pathophysiology, biochemical, clinical and nutritional needs and diet modification in the treatment of diseases. Prerequisites: HEFS-130, 337, 630.

**HEFS-679. Nutrition Education****Credit 3 (3-0)**

This course covers the philosophy, principles, methods and materials involved in nutrition education. Application of nutrition knowledge and skills in the development of the nutrition education curriculum and programs in schools and communities is implemented. Prerequisites: 332, 337, students must be advanced undergraduate or graduate level.

## GRADUATE STUDENTS ONLY

- HEF-715. Trace Elements and Nutrition** **Credit 3 (3-0)**  
Physiological functions and requirements of trace minerals as well as the roles of trace minerals in health and disease will be discussed.
- HEFS-730. Nutrition in Health and Disease** **Credit 3 (3-1)**  
Significance of nutrition in health and disease. Consideration of: (1) the methods of appraisal of human nutritional status to include clinical, dietary, biochemical, and anthropometric techniques; (2) various biochemical parameters used to diagnose and treat disorders; and (3) the role of diet as a therapeutic tool. Prerequisite: HEFS-630 or equivalent.
- HEFS-733. Nutrition During the Growth and Development** **Credit 3 (2-2)**  
Nutritional, genetical and environmental influences on human growth and development. Prerequisite: HEFS-630 or equivalent.
- HEFS-734. Nutrition Education** **Credit 3 (2-2)**  
Interpretation of the results of nutrition research for use with lay groups. Preparation of teaching materials based on research for use in nutrition education programs.
- HEFS-735. Experimental Foods** **Credit 3 (2-2)**  
Objective and subjective evaluation of food, development and testing of recipes, and experimentation with food. Prerequisite: HEFS-236 or equivalent.
- HEFS-736. Research Methods in Food and Nutrition** **Credit 4 (2-6)**  
Experimental procedures in food and nutrition research, care of experimental animals, analysis of food, body fluids, and animal tissues. Prerequisites: Analytical Chemistry and Biochemistry.
- HEFS-739. Thesis Research** **Credit 3 (0-6)**  
Research problems in food or nutrition.
- HEFS-740. Community Nutrition** **Credit 3 (3-0)**  
Individualized work, team teaching or guest speakers. Application of the principles of nutrition to various community nutrition problems of specific groups (geriatrics, preschoolers, adolescents and expectant mothers). Evaluation of nutrition programs of public health and social welfare agencies at local, state, federal and international levels.
- HEFS-742. Cultural and Social Aspects of Food and Nutrition** **Credit 3 (3-0)**  
Sociological, psychological, and economical background of ethnic groups and their influence on food consumption patterns, and nutritional status.
- HEFS-744. Seminar in Food and Nutrition** **Credit 2 (2-0)**  
Required of all graduates in Food and Nutrition.
- HEFS-745. Practicum in Food or Nutrition** **Credit 3 (0-6)**  
Field experiences with private or public agencies.

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## Industrial and Systems Engineering Department

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Eui H. Park, Chairperson  
419 McNair Building  
(336) 334-7780

### OBJECTIVE

The Master of Science and Doctor of Philosophy Programs in Industrial Engineering are designed to meet the need for technical and/or managerial specialists in Industrial Engineering. Four areas of concentration (Human-Machine Systems Engineering (HMSE), Management Systems Engineering (MSE), Production Systems Engineering (PSE), and Operations Research and Systems Analysis (ORSA) are being offered.

### DEGREE OFFERED

Industrial Engineering - Master of Science  
Industrial Engineering - Ph.D.

### GENERAL PROGRAM REQUIREMENTS

The program is open to students with a bachelor's degree in a scientific discipline from an institution of recognized standing. Students desiring to enter the program, who do not possess a bachelor's degree in a scientific discipline are required to complete with at least a "B" average, a number of background courses in mathematics, physics and engineering science prior to admission to the graduate program. Students entering the program without a bachelor's degree in Industrial Engineering from an accredited department are required to remove all deficiencies in general professional prerequisites.

Graduate Record Examination scores will be given consideration in making decisions regarding financial assistance.

### PROGRAM OPTIONS AND DEGREE REQUIREMENTS

For the Master of Science Program two degree options are available, namely, Thesis and Project. The thesis option requires 24 semester hours of course work and 6 hours of thesis culminating in scholarly research work. The project option requires 30 semester hours of course work and 3 hours of project work. Both options require an oral examination and a written report. To graduate, a student must maintain a 3.0 grade point average.

The Ph.D. program requires a total of 75 semester hours after the B.S. degree, which includes 18 semester hours of dissertation work. The Ph.D. program offers specialization in Human-Machine Systems Engineering (HMSE), Management Systems Engineering (MSE), and Production Systems Engineering (PSE).

Additional details of requirements for the M.S. and Ph.D. programs in Industrial Engineering are outlined in the Graduate Program Student Handbook available from the department.

### List of Courses

		Credits
INEN 600	Survey of Industrial Engineering Topics	3
INEN 615	Industrial Simulation	3
INEN 618	Total Quality Improvement	3



INEN 624	Computer-Integrated Design / Manufacturing	3
INEN 625	Industrial Information Systems	3
INEN 632	Robotic Systems and Applications	3
INEN 633	Engineering Law and Ethics	3
INEN 635	Materials Handling Systems Design	3
INEN 648	Biomechanics	3
INEN 658	Project Management	3
INEN 664	Systems Safety Engineering and Risk Analysis	3
INEN 665	Human-Machine Systems	3
INEN 670	Principles of Ergonomics	3
INEN 675	Design and Analysis of Experiments	3
INEN 685	Selected Topics in Industrial Engineering	Var. 1-3
INEN 694	Special Projects	Var. 1-3
INEN 721	Systems Engineering Models	3
INEN 731	Engineering Cost Control	3
INEN 734	Engineering Organization	3
INEN 735	Human-Computer Interface	3
INEN 745	Advanced Computer-Integrated Production Systems	3
INEN 749	Inventory Systems Analysis and Design	3
INEN 812	Advanced Ergonomics	3
INEN 813	Cognitive Systems Engineering	3
INEN 814	Advanced Topics in Human-Machine Systems	3
INEN 821	Multivariate Statistics for Engineering	3
INEN 822	Advanced Systems Simulation	3
INEN 831	Service Sector Engineering	3
INEN 832	Information Technology Management	3
INEN 833	Supply Chain Systems Engineering	3
INEN 841	Linear and Nonlinear Optimization	3
INEN 843	Queuing Theory	3
INEN 844	Reliability and Maintenance	3
INEN 851	Integrated Manufacturing Control Systems	3
INEN 852	Integrated Product and Process Design	3
INEN 853	Enterprise Integration	3
INEN 854	Inventory & Warehouse Systems	3
INEN 885	Advanced Special Topics in Industrial Engineering	3

### **M.S. level Pass/Fail Courses**

INEN 792	Industrial Engineering Master's Seminar	1
INEN 793	Master's Supervised Teaching	3
INEN 794	Master's Supervised Research	3
INEN 796	Master's Project	3
INEN 797	Master's Thesis	Var. 1-3

### **Ph.D level Pass/Fail Courses**

INEN 991	Doctoral Qualifying Examination	1
INEN 992	Doctoral Seminar in Industrial engineering	1
INEN 993	Doctoral Supervised Teaching in Industrial Engineering	3
INEN 994	Doctoral Supervised Research in Industrial Engineering	3

INEN 995	Doctoral Preliminary Examination	3
INEN 997	Dissertation	Var. 1-3
INEN 999	Continuation of Dissertation	1

## COURSE DESCRIPTION

### Advanced Undergraduate and Graduate

#### **INEN-600. Survey of Industrial Engineering Topics Credit 3 (3-0)**

This course will introduce topics in the following areas of Industrial Engineering: Engineering Economy, Linear Programming, Production Control, Methods Engineering, and Statistical Process Control. Prerequisite: Senior/Graduate Standing.

#### **INEN-615. Industrial Simulati Credit 3 (3-0)**

This course addresses discrete-event simulation languages. One general purpose simulation language is taught in depth. The use of simulation in design and improvement of production and service systems is emphasized. Term papers and projects will be required. Prerequisite: Senior/Graduate Study.

#### **INEN-618. Total Quality Improvement Credit 3 (3-0)**

This course provides a systematic engineering approach to understanding the philosophy and application of Total Quality Improvement (TQI). It also introduces students to Continuous Improvement (C) techniques used by management as a means of improving engineering processes in order to become and remain competitive in the global marketplace. The C1 techniques and concepts this course includes a strategic planning, benchmarking, ISO 9000, teamwork, customer satisfaction, employee involvement, quality tools, and business process reengineering. Design projects are required. Prerequisite: Senior/Graduate Standing.

#### **INEN-624. Computer-Integrated Design / Manufacture Credit 3 (2-2)**

This course addresses Computer-based tools and techniques for integrated product and process design. Topics include numerical computer-aided design and process planning, group technology, numerical control, computer numerical control, and direct numerical control, rapid response technologies, integrated manufacturing planning, execution, and control and computer-integrated manufacturing. Design projects are required. Prerequisite: Senior/Graduate Standing.

#### **INEN-625. Information Systems Credit 3 (3-0)**

This course introduces the planning, design, implementation and evaluation of industrial information systems. Analysis and design techniques, organization of data, current software tools, client-server architectures, and current database technologies are presented. The role of information systems in global manufacturing, distribution, and services is addressed. Design projects are required. Prerequisite: Senior/Graduate Standing.

#### **INEN-632. Robotic Systems and Applications Credit 3 (2-2)**

This course addresses design, analysis, implementation and operation of robotics in production systems. End effectors, vision systems, sensors, stability and control off-line programming, and simulation of robotic systems are covered. Methods for planning robotic work areas are emphasized. Design projects are required. Prerequisite: Senior/Graduate Standing.

#### **INEN-633. Engineering Law and Ethics Credit 3 (2-2)**

This course introduces engineers to law and ethics. Topics include contract law and practices, product liability, intellectual property and patent law, research and development contracts, environmental law, interstate commerce regulations, labor law, workers compensation, safety

regulations, ethical issues involving conflict of interest, and confidentiality. Prerequisite: Senior/Graduate Standing.

**INEN-635. Materials Handling Systems Design** **Credit 3 (2-2)**

This course focuses on design, and analysis of materials handling and flow in manufacturing facilities. Principles, functions, equipment and theoretical approaches in materials handling are discussed. Tools for the automation of materials handling are introduced. Design projects are required. Prerequisite: Senior/Graduate Standing.

**INEN-648. Biomechanics** **Credit 3 (3-0)**

This course covers human biomechanical and physiological behavior during work. Quantitative methods using engineering mechanics principles and computer simulation are emphasized. Prerequisite: Senior/Graduate Standing.

**INEN-658. Project Management** **Credit 3 (3-0)**

This course addresses project proposal preparation, resource and cost estimation, project planning, organizing and controlling, network diagrams, and computerized project planning systems. Prerequisite: Senior/Graduate Standing.

**INEN-664. Systems Safety Engineering and Risk Analysis** **Credit 3 (3-0)**

This course presents the principles and methods of system safety management and risk analysis. Quantitative and qualitative methods and their applications in safety and risk analysis of human-machine systems are emphasized.

**INEN-665. Human Machine Systems** **Credit 3 (2-2)**

This course introduces behavioral and psychological factors such as sensory, perception and attention, decision making and cognitive processes. This course emphasizes the applications of these factors to the design and development of man-machine systems. Design projects are required. Prerequisite: Senior/Graduate Standing.

**INEN-670. Principles of Ergonomics** **Credit 3 (3-0)**

This course presents an overview of ergonomics principles including human physical and mental characteristics. Applications to human-machine systems are emphasized. Prerequisite: Senior/Graduate Standing.

**INEN-675. Design and Analysis of Experiments** **Credit 3 (3-0)**

This course addresses various experimental designs, to analyze data for research projects, process improvements, human factors studies, and surveys. Designs covered include Latin Squares, complete and incomplete block designs, one, two, and three variable factorials, fractional factorials, nested designs, and 2k designs. Suitable laboratory apparatus will be set up to study the effect of design parameters on selected response. Statistical software will be utilized to analyze results. Parametric statistics such as analysis of variance (ANOVA) are introduced. Prerequisite: Senior/Graduate Standing.

**INEN-685. Selected Topics in Industrial Engineering** **Var. Credit (1-3)**

Selected engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Senior/Graduate Standing.

**INEN-694. Special Projects** **Var. Credit (1-3)**

Study arranged on a special engineering topic of interest to student and faculty member, who will act as advisor. Topics may be analytical and/or experimental and encourage independent study. Prerequisite: Consent of the instructor.

**INEN-721. Systems Engineering Models** **Credit 3 (3-0)**

This course presents an overview of modern quantitative and computational techniques for system modeling, design and control. Topics include fuzzy set theory, neural network, control theory, optimization search methods, Petri-nets, and knowledge-based systems. Prerequisite: Graduate Standing.

**INEN-731. Engineering Cost Control** **Credit 3 (3-0)**

This course is designed to emphasize the use of cost data by engineers in support of the financial management function. Cost functions, cost behavior, cash control, budgeting, and cash-flow analysis are discussed.

**INEN 734. Engineering Organization** **Credit 3 (3-0)**

This course presents theories of organizational structures, motivation, leadership, delegation, incentives and rewards systems, teams, strategic planning, and personnel evaluation. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-735. Human-Computer Interface** **Credit 3 (3-0)**

This course provides a fundamental coverage of topics in human-computer interface (HCI). The primary emphasis is on the impact of human characteristics and the use of information processing models for HCI-design, usability evaluation, virtual reality, and multimedia systems. Prerequisite: Graduate Standing.

**INEN-745. Advanced Computer-Integrated Production Systems** **Credit 3 (3-0)**

This course addresses the principles relating to integration issues for an automated manufacturing enterprise. Topics include control architectures, communication networks and standards for graphical information interchange. Current research areas will be discussed. Design projects are required. Prerequisites: INEN-624 and INEN-635.

**INEN-749. Inventory Systems Analysis and Design** **Credit 3 (3-0)**

This course presents quantitative models for inventory control decisions. The concepts behind current manufacturing resource planning software tools are discussed. Projects are required. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-812. Advanced Ergonomics** **Credit 3 (3-0)**

This course covers quantitative and qualitative analysis of human motions in space and time. Sample topics include human physiology, anthropometry, human figure modeling, and human performance for a set of task requirement and specification. Design projects are required. Prerequisite: Graduate Standing.

**INEN-813. Cognitive Systems Engineering** **Credit 3 (3-0)**

Cognitive Systems Engineering This course examines the principles, theories, and applications of the cognitive basis of system design. Topics include models of human and machine information processing, mental models, human error, human-centered design, abstraction hierarchy, ecological interface, cognitive task analysis, multi-flow models, activity-behavior models, and theories of complexity in human-machine systems. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-814. Advanced Topics in Human-Machine Systems** **Credit 3 (3-0)**

This course examines advanced topics in human-machine systems. Topics covered include supervisory control, human aspects of fixed and programmable automation, theories and models of complex systems, collaborative work support systems, human attention and cognitive control of dynamic actions, and tele-operations. Applications include supervisory control in trans-



portation, process, space operations, waste and hazardous handling, manufacturing, and other applications of automated systems. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-821. Multivariate Statistics For Engineers** **Credit 3 (3-0)**

This course focuses on methods for statistical analysis of multivariate data. Topics include: dimensionality, multidimensional classification and clustering, unstructured multi-response sampling, analysis of covariance structures, such as principal components, factor analysis and canonical correlation analysis, and multivariate normal distribution and analysis of multivariate means. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-822. Advanced Systems Simulation** **Credit 3 (3-0)**

This course discusses advanced statistical issues in the design of simulation experiments: variance reduction, regeneration methods, performance optimization and run sampling. Continuous simulation models are introduced. High fidelity simulation software and high-level architecture for constructing large simulation models is introduced. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-831. Service Sector Engineering** **Credit 3 (3-0)**

This course focuses on the application of modeling and analysis of enterprises in the service sector of an economy. Topics include the role of the service sector in an economy, special characteristics of service operations, structuring the service enterprise, facility design for services, service quality, quantitative models for managing services. Applications in the financial services, health care, and other sectors will be emphasized. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-832. Information Technology Management** **Credit 3 (3-0)**

This course focuses on productivity measurement and improvement of information technology and information system services. Other topics covered include the planning and control of human resources and budgets, as well as the planning of innovation, entrepreneurship and research and development, and the forecasting and justification of technology. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-833. Supply Chain Systems Engineering** **Credit 3 (3-0)**

This course addresses the analysis and design of logistics and supply chain systems. Topics covered include: logistics and supply chain characterization, site location, mode selection, distribution planning, vehicle routing, demand management, replenishment management, geographic information systems and real-time logistics control issues. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-841. Linear and Nonlinear Optimization** **Credit 3 (3-0)**

This course addresses solution techniques for linear and integer programming problems, and nonlinear optimization. Topics addressed include initial basic feasible solutions, large scale linear programs, column generation, scaling, Dantzig-Wolfe decomposition, interior point methods, integer programming models, branch and bound approaches, unconstrained multivariate optimization, and penalty methods. Applications to engineering and economic systems are discussed. Prerequisite: Graduate Standing.

**INEN-843. Queuing Theory** **Credit 3 (3-0)**

This course presents stochastic models and solution techniques for such models. Specific topics include elements of queuing systems, measures of performance, arrival processes, steady state analysis, stationary arrivals, controlling service processes, priority queues, and queuing networks. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-844. Reliability and Maintenance****Credit 3 (3-0)**

This course reviews the statistical concepts and methods underlying procedures used in reliability engineering. Topics include the nature of reliability and maintenance, life failure and repair distributions, life test strategies, and complex system reliability including: series/parallel/standby components with preventive maintenance philosophy. Analytical models are emphasized. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-851. Integrated Manufacturing Control Systems****Credit 3 (3-0)**

This course provides an advanced study of systems used for manufacturing execution and shop floor control. Traditional control and adaptive control algorithms and applications for manufacturing are explored. Integrated control system functions include scheduling, execution planning, supervisory control, human machine interface, process control, quality control, and information acquisition. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-852. Integrated Product and Process Design****Credit 3 (3-0)**

This course provides an integrated approach to the design and manufacture of a new product. Topics include product requirements, concept generation and selection, design, product optimization, tolerances, prototype development, design for manufacturability and assembly, process optimization, and quality function deployment. Prerequisite: Graduate Standing.

**INEN-853. Enterprise Integration****Credit 3 (3-0)**

This course is directed toward development and contribution to the advancement of a unified framework for conceptualizing, designing, modeling, and operating advanced integrated manufacturing systems. It builds upon emerging developments in computer and communications technologies and conceptual breakthroughs regarding the nature and behavior of integrated enterprises. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-854. Inventory & Warehouse Systems****Credit 3 (3-0)**

This course investigates the integration of inventory and warehouse systems. Quantitative models for inventory and warehouse layout/location are developed and solved. Computational tools and equipment in inventory and warehouse systems are reviewed. Application of supply chain and information technology concepts to strategic inventory and warehouse system integration is addressed. Prerequisite: Graduate Standing.

**INEN-885. Advanced Special Topics in Industrial Engineering****Credit 3 (3-0)**

The course will address a current body of knowledge in Industrial Engineering with a research orientation. Term papers and projects will be required. Prerequisites: Graduate Standing and Consent of Instructor.

**INEN-991. Doctoral Qualifying Examination****Credit 1 (1-0)**

This course will guide student to take the departmental Qualifying Examination. The examination will be administered towards the end of the semester. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing.

**INEN 992. Doctoral Seminar in Industrial Engineering****Credit 1 (1-0)**

The course will present potential dissertation topics and research work-in-progress by faculty members and doctoral students, and talks by eminent practitioners and researchers on classical and contemporary topics in Industrial Engineering. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing.

**INEN-993. Doctoral Supervised Teaching in  
Industrial Engineering****Credit 3 (3-0)**

This course will introduce the student to teaching courses under the guidance of a faculty member. This course will give the student experience in course planning, lecture preparation,

classroom teaching, and student evaluation. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing.

**INEN-994. Doctoral Supervised** **Credit 3 (3-0)**

This is supervised research under the direction of a member the Graduate Faculty. This research should lead to the identification of a dissertation topic. Pass/Fail evaluation only, no letter grade will be given. Prerequisite: Doctoral Standing.

**INEN-995. Doctoral Preliminary** **Credit 3 (3-0)**

In this course dissertation supervisors will guide their students towards completing the Preliminary Exam. The Preliminary Exam will consist of presenting and defending the student's dissertation proposal, and a written exam in the area of specialization. Pass/Fail evaluation only, no letter grade will be given. Prerequisites: Doctoral Standing and satisfactory completion of departmental Qualifying Examination.

**INEN-997. Dissertation** **Var. Credit (1-3)**

**INEN-999. Continuation of Dissertation** **Var. Credit 1 (1-1)**

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## Industrial Technology

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### PROGRAM DESCRIPTION

The School of Technology at North Carolina A&T State University offers a Master of Science in Industrial Technology (MSIT) degree. This program is coordinated by the Department of Manufacturing Systems and is designed to increase students' understanding of industrial management challenges in an array of technical areas and to explore effective methods for dealing with accelerated technological change.

### AREAS OF CONCENTRATION

The MSIT degree program has five areas of Technical Concentrations. The student program of study determines the area of concentration. The difference in each concentration will be in the area of Management Electives and Technical Electives. **Note: Each student should consult with a coordinator in the department of interest to develop a program of study.**

The five Concentration areas are:

1. Manufacturing Systems
2. Electronics and Computer Technology
3. Graphic Communication Systems
4. Construction Management
5. Occupational Safety and Health

### ADMISSION REQUIREMENTS

The Master of Science in Industrial Technology, within the School of Technology, requires the GRE General Test as part of the admission process. No minimum score is required at this time. Please contact the Graduate School Office for more information.

### PROGRAM OBJECTIVES

The MSIT degree program is built upon the competencies achieved at the baccalaureate level in the industrial technology curriculum and thus enable students to secure applications oriented "technical-management" positions in today's industrial environment. Specifically, the MSIT program is designed to prepare technical-management professionals and enhance their proficiencies in the following areas:

1. Planning, organization and management of technology, people, and resources;
2. Applying and controlling the use of various high technologies, e.g., computer-aided drafting and design (CADD), computer integrated manufacturing (CIM), machine vision and photonics, telecommunications and wireless communications, computerized construction estimating systems, safety support systems, etc.
3. Control processes to improve quality, reliability and productivity
4. Human resource management and the development of a changing work place to achieve organizational goals; and
5. Problem-solving and creative thinking skills.



## TARGET AUDIENCE AND CAREER OPPORTUNITIES

This program is designed to serve the diverse needs of persons who are interested in pursuing careers in technology. Included in this group are the following: (1) persons currently employed in industrial management positions and have professional growth aspirations; (2) individuals recently completing their undergraduate study and want additional preparation prior to embarking on a career in industry; and (3) students interesting in entering an advanced graduate degree program (Ph.D., Ed.D., etc.) and whose ultimate goal is university teaching and/or research. Graduates of the program should be able to perform more creatively and competently in leadership roles involving planning, problem solving, and decision-making. Additionally, the program is designed to enhance student competencies in the areas of research and scholarly writing.

## INDUSTRIAL TECHNOLOGY

*A total of 36 hours is required for the Master of Science in Industrial Technology. The total consists of 12 SH of Core Courses, 6 SH of Management Electives, 9 SH of Technical Electives and 9 SH of Required Courses.*

### PROGRAM CURRICULA

<b>Core Courses</b> (12 credit hours) <i>Requirement for all concentrations</i>		<b>Credits</b>
MSIT 610	Problem Solving in Industrial Technology	3
MSIT 673	Industrial Productivity Measurement and Analysis	3
MSIT 700	Concepts of Technological Innovations	3
MSIT 740	Leadership Development Seminar	3

#### **Manufacturing Systems**

##### **-Management Electives-**

MFG 735	Manufacturing Organization and Management	3
MFG 745	Managing Project Development	3
MFG 755	Production Management and Control	3
MFG 770	Managing a Total Quality System	3

##### **-Technical Electives-**

MFG 651	Principles of Robotics	3
MFG 674	Advanced Automation and Control	3
MFG 690	Special Problems in Manufacturing Systems	3
MFG 696	Applied Computer Integrated Manufacturing	3
MFG 699	Independent Study in Manufacturing Technology	3
MFG 710	Manufacturing Materials	3
MFG 715	Tool Technology	3
MFG 760	Advanced Manufacturing Process/CNC	3
MFG 780	Reliability Testing and Analysis	3
MFG 799	Special Topics in Manufacturing Technology	3

#### **Electronics and Computer Technology**

##### **-Management Electives-**

ECT 620	Telecommunications Management	3
ECT 730	Systems Integration for Telecommunications Managers	3

ECT 735	Telecommunications Management Issues	3
	-Technical Electives-	
ECT 610	Digital Communications I	3
ECT 611	Digital Communications II	3
ECT 630	Electronic Communications Networks	3
ECT 634	Electronic Instrumentation for Telemetry Applications	3
ECT 640	Electronic Automated Testing Systems	3
ECT 650	Wireless Communication Systems I	3
ECT 655	Optical Communication Systems I	3
ECT 660	Satellite and Personal Communications Systems	3
ECT 665	Wireless Geo-location Systems	3
ECT 670	Communication Circuit Development Laboratory	3
ECT 690	Special Problems in Electronics & Computer Technology	3
ECT 699	Independent Study in Electronics & Computer Technology	3
ECT 755	Optical Communication Systems II	3
ECT 759	Special Topics in Electronics & Computer Technology	3
ECT 760	Wireless Communication Systems II	3
ECT 770	Communication Circuit Development Laboratory II	3

### **Construction Management**

#### **-Management Electives-**

CM 692	Project Management	3
CM 710	Advanced Construction Management and Organization	3
CM 720	Construction Contract Administration	3

#### **-Technical Electives-**

CM 603	Environmental Issues in Construction Technology	3
CM 617	Independent Study I	3
CM 618	Independent Study II	3
CM 650	Construction Contracts and Law	3
CM 675	Advanced Construction Planning and Scheduling	3
CM 678	Real Estate and Land Development	3
CM 685	Experiential Graduate Internship	3
CM 686	Special Problems in Construction Management	3
CM 715	Productivity and Methods Improvement in Construction	3
CM 750	Research Methods in Construction	3

### **Graphic Communication Systems and Technological Studies**

#### **-Management Electives-**

GCS 637	Industrial and Customer Relations in Graphic Communications	3
GCS 733	Graphic Communications Organization & Management	3
TECH 670	Introduction to Workplace Training and Development	
TECH 671	Methods & Techniques of Workplace Training & Development	3

#### **-Technical Electives-**

GCS 601	Advanced Flexographic Methods	3
GCS 616	Electronics Imaging in Graphic Communication	3
GCS 630	Multimedia and Videography	3

GCS 631	Advanced Computer-Aided Design	3
GCS 632	Graphic Animation	3
GCS 633	Advanced Machine Design and Drafting	3
GCS 634	Advanced Multimedia and Videography	3
GCS 635	Advanced Principles of Graphic Communications Technology	3
GCS 636	Electronics Imaging in Distance Education	3
GCS 644	Advanced Architectural Drafting and Design	3
GCS 668	Independent Studies in Technological Education	3
GCS 719	Seminar in Computer-Aided Drafting and Design	3
GCS 731	Advanced Graphic Techniques	3
TECH 717	Special Problems I	3
TECH 718	Special Problems II	3

### **Occupational Safety and Health**

#### **-Management Electives-**

OSH 614	Industrial Relations	3
OSH 708	Occupational Safety and Health Management	3
OSH 709	Current Issues in Occupational Health and Safety	3
OSH 710	Legal Issues in Occupational Health and Safety Practice	3

#### **-Technical Electives-**

OSH 600	Occupational Toxicology I	3
OSH 613	Industrial Hygiene Ventilation	3
OSH 630	Industrial Safety	3
OSH 632	Design of Engineering Hazard Controls	3
OSH 637	Machine and Welding Safety	3
OSH 642	Electrical Safety	3
OSH 672	Systems Safety and Other Analytical Methods	3
OSH 678	Experiential Education I	3
OSH 679	Experiential Education II	3
OSH 700	Special Problems in Occupational Health & Safety	3
OSH 704	Occupational Epidemiology	3
OSH 706	Noise Control	3
OSH 712	Education and Training Methods for Safety	3
OSH 731	Toxicology for the Industrial Hygienist	3
OSH 751	Industrial Ventilation	3

### **Required Courses (9 hours) Requirement for all concentrations**

#### ***Non-Thesis Option***

MSIT 750	Internship I	3
MSIT 751	Internship II	3
MSIT 789	Master's Project	3

#### ***Thesis Option***

MSIT 790	Research Methods	3
MSIT 791	Thesis I	3
MSIT 792	Thesis II	3

# INDUSTRIAL TECHNOLOGY

## Courses with Description

### Manufacturing Systems

#### **MSIT-610. Problem Solving in Industrial Technology** **Credit 3 (3-0)**

This course teaches fundamentals of problem solving as they are applied to an industrial technology environment. Included are analytical as well as creative problem solving techniques. Industrial projects within assigned teams are required.

#### **MFG-651. Principles of Robotics** **Credit 3 (1-3)**

This course emphasizes the study of robotics principles and logic control manipulators towards the total integration into a flexible manufacturing system.

#### **MSIT-673. Industrial Productivity Measurement and Analysis** **Credit 3 (3-0)**

Study of work measurement and method analysis towards establishing work standards and measuring productivity in industries.

#### **MFG-674. Study of Automation and Control Systems** **Credit 3 (1-3)**

This course emphasizes the study of automation and control system to include application of PLC, CAD, CAM, CNC, sensors and robotics to simulate a total computer-integrated manufacturing (CIM) environment.

#### **MFG-690. Special Problems in Manufacturing Technology** **Credit 3 (3-0)**

This course is to provide a forum for dialogue about areas of student's interest pertaining to issues and or skill developments. This will be accomplished through the definition, exploration, and tentative resolution of selected current and evolving industrial technology. This experience is targeted toward providing one the opportunity to think about a particular concern and/or interest then to develop a final product, in the form of paper and presentation, etc.

#### **MFG-696. Applied Computer Integrated Manufacturing (CIM)** **Credit 3 (2-2)**

This course is designed to provide a working knowledge of computer integrated manufacturing (CIM). It will provide hands-on experience using sensing devices necessary to control a CIM system. Prerequisite: MFG-674.

#### **MFG-699. Independent Study in Manufacturing Technology** **Credit 3 (3-0)**

The student selects a problem, either management or technical in nature, in consultation with a faculty member in this area of interest. This problem may be research or application oriented in nature. A standard report format will be required. Prerequisite: Consent of the instructor.

#### **MFG-700. Concepts of Technological Innovations** **Credit 3 (3-0)**

This course will provide instruction in the concepts of technological innovations. Contemporary issues are also explored.

#### **MFG-710. Manufacturing Materials** **Credit 3 (3-0)**

This course surveys the materials commonly used to manufacture products. It explores the way these materials are formed. Covered are traditional metals and plastics as well as emerging high tech materials. The practical applications of these materials are emphasized. Prerequisite: MFG-471 or equivalent or consent of instructor.

#### **MFG-715. Tool Technology** **Credit 3 (2-1)**

Includes coverage of tool layout, tool material, tool wear and failure, work holding principles, jig and die, specifications for press working, blanking, bending, forming, drawing, and forging, etc. Tooling for joining processes such as welding, soldering, brazing, mechanical joining,



and adhesive bonding are covered, as well as the use of computers in tooling. Prerequisite: MFG-472 or equivalent or consent of instructor.

**MFG-735. Manufacturing Organization and Management** **Credit 3 (3-0)**

This course surveys contemporary manufacturing organization and management issues. Focusing on manufacturing aspects of the product cycle, research and development, product design, marketing, sales and distribution. This course explores new trends in technology management and quality of work life issues.

**MSIT-740. Leadership Development Seminar** **Credit 3 (3-0)**

This is an experiential seminar designed for assessment of the individual's managerial strengths and weaknesses in a manufacturing management position. Current and evolving leadership issues will be discussed and leadership models will be presented. Managerial and leadership issues in high participation work places will be stressed. Students will participate in behavioral simulations and receive psychometric feedback.

**MFG-745. Managing New Product Development** **Credit 3 (3-0)**

This course covers the product development cycle and emphasizes the benefits of Early Manufacturing Involvement (EMI) and Logistics Processes. Use of cross-functional teams in product development is also explored.

**MSIT-750. Internship I** **Credit 3 (0-6)**

This course is designed to provide students with an internship experience in an industrial environment related to their technical discipline. Students must be employed full-time for one semester. Evaluation will be based on reports from the student's industrial supervisor and the university coordinator. Prerequisite: 15 hours graduate credit.

**MSIT-751. Internship II** **Credit 3 (0-6)**

This course is designed to provide students with an additional semester of internship experience related to their technical discipline.

**MFG-755. Production Management and Control** **Credit 3 (3-0)**

This course focus is on production scheduling, work flow, and inventory flow, Just-in-time (JIT), and Material Resources Planning (MRP) are explored as techniques for structuring production as well as inventory management. Traditional work design is compared to newer, more high participative work designs including self-managed teams.

**MFG-760. Advanced Manufacturing Process/Computer Numerical Control (CNC)** **Credit 3 (1-2)**

This course explores applications in advanced Computer Numerically Controlled (CNC) machine tool technology with precision work performed on lathes, mill, Electrostatic Discharge Machining (EDM), and surface drilling work stations. Prerequisite: MFG-472 or consent of instructor

**MFG-770. Managing a Total Quality System** **Credit 3 (3-0)**

The study of total quality control systems assists to reduce defects, lower cost, and increase productivity in a manufacturing environment. Study includes implementing quality through Statistical Process Control (SPC), managing quality, quality information systems, quality circles, and quality work-life concepts. Prerequisite: MFG-495 or equivalent or consent of instructor

**MFG-780. Reliability Testing and Analysis****Credit 3 (3-0)**

Study of Metrology and reliability testing at various stages of manufacturing processes for zero failures. Includes destructive and non-destructive testing procedures, failure analysis, exponential and Weibull Failure Law, and reliability prediction of components and/or systems.

**MSIT-789. Master's Degree Project****Credit 3 (3-0)**

The master's degree project is designed to be a culminating experience for the master's degree. It is applications oriented and focuses on an actual project related to the student's technical discipline. The course is intended to integrate the learning from the classes taken in the degree program. Prerequisite: 24 hours graduate credit.

**MSIT-790. Research Methods****Credit 3 (3-0)**

This course explores empirical methodologies that are applicable to technical research investigation. Prerequisites: Graduate standing and consent of thesis advisor.

**MSIT-791. Thesis I****Credit 3 (3-0)**

The student will select a research topic that is of special interest and approved by his/her graduate thesis advisor. Prerequisite: MSIT 790 or consent of advisor.

**MSIT-792. Thesis II****Credit 3 (3-0)**

The student may enroll in this course to complete approved research for the thesis. Prerequisites: MSIT 790, MSIT 791 or consent of advisor.

**MFG-799. Special Topics in Manufacturing Technology****Credit 3 (3-0)**

This course will allow a group of students to work on special topics of interest which are not covered by an existing course. These are emerging themes that reflect the rapidly changing nature of "World Class Manufacturing" environments. Prerequisite: Consent of the instructor.

**Electronics and Computer Technology****ECT-610. Digital Communications****Credit 3 (2-2)**

This course investigates the exchange of digital data between terminals and computers. Topics include multiplexing, modems, causes and correction of electronic circuit impairments. Analog and digital communication systems are analyzed and contrasted. Prerequisite: ECT 350.

**ECT-611. Digital Communications II****Credit 3 (2-2)**

This course is a continuation of ECT 610. Emphasis is placed on multimedia networks and their supporting platforms. Topics include audio and video standards and compression schemes, cable modems and xDSL schemes. Prerequisite: ECT 610 or departmental approval.

**ECT-620. Telecommunications Management****Credit 3 (2-2)**

This course addresses fundamental principles of telecommunications management, which includes network management and administration, the telecommunications marketplace, and the planning and evaluation of systems. The technology of modern telecommunications systems is also reviewed. Prerequisite: ECT 350.

**ECT-730. System Integration for Telecommunications Managers** **Credit 3 (3-0)**

This course delineates methods by which a telecommunications system can put together to serve the needs of an organization. Students trace how the project manager should operate under constraints of time, cost, performance, competition and regulation. The course involves extended case studies and a group project. Prerequisites: ECT 620, CM 590 or Equivalent. (F)

**ECT-735. Telecommunication Management Issues** **Credit 3 (3-0)**

This course assesses the impact of current and future trends on the telecommunication landscape. Topics include technological changes, strategic planning, financial analysis and the roles of organizational entities, such as research and development, production, human resources and operations. Prerequisites: ECT 620, 730.

**ECT-630. Electronic Communications Networks** **Credit 3 (2-2)**

This course involves an intensive investigation of the principles involved in designing Local Area Networks (LANs), Metropolitan Area Networks (MANs), and Wide Area Networks (WANs). The student will be required to design an appropriate network to meet pre-determined specifications. Prerequisite: ECT 350.

**ECT-634. Electronic Instrumentation for Telemetry Applications** **Credit 3 (2-2)**

This course will provide practical knowledge of the operation of electronics instruments used in the applications of telemetry, remote sensing and detection. Possible electronic systems that will be discussed include RADAR, SONAR, LIDAR, and SODAR. Prerequisite: ECT 334 or departmental approval.

**ECT-640. Electronic Automated Testing Systems** **Credit 3 (2-2)**

This course addresses the fundamentals of electronic automated testing systems. Topics include production, reliability, and maintenance testing. Various types of Automated Test Equipment (ATE) are addressed, including Built In Test Equipment (BITE) and stand-alone systems. Prerequisite: ECT 360.

**ECT-650. Wireless Communication Systems** **Credit 3 (3-0)**

This course covers fundamental theory and design of high capacity wireless communication systems. Topics include trunking, propagation effects, frequency reuse, modulation methods, coding and equalization. Emerging cellular and next generation personal communication systems will also be analyzed. Prerequisite: ECT 610.

**ECT-655. Optical Communications Systems** **Credit 3 (3-0)**

This course covers advanced fiber optic communication technology (including lasers, optical amplifier dynamics and turntable optical filters) with applications to high speed long distance systems, local area networks and communication systems. Prerequisite: ECT 450.

**ECT-660. Satellite and Personal Communication Systems** **Credit 3 (3-0)**

This course covers the theory and practice of satellite communications including orbits, launchers, spacecraft, link budgets, modulation techniques, coding, multiple access techniques, propagation effects and earth terminals. Prerequisite: ECT 610.

**ECT- 665. Wireless Geolocation Systems** **Credit 3 (2-2)**

This course covers the various technologies and application of wireless geo-location systems. Topics covered include terrestrial based systems such as angle of arrival (AOA), time difference of arrival (TDOA), and satellite based such as Global Positioning System (GPS). This course will also discuss alternative implementation techniques for position location systems such as the inertial navigation systems. Prerequisite: ECT 350 or departmental approval.

**ECT-670. Communication Circuit Development Laboratory** **Credit 3 (1-4)**

This course studies advanced methods of analysis of communication circuits including oscillators, radio frequency amplifiers, matching networks, modulators, mixers, and detectors for the HF through UHF frequencies range using Y- and S- parameter methods. Prerequisite: ECT 350.

**ECT-690. Special Problems in Technology****Credit 3 (0-6)**

Intensive study in the field of electronics and computer technology under the direction of a faculty advisor.

**ECT-699. Independent Study in Electronics and Computer Tech. Credit 3 (3-0)**

The student selects a problem (technical or managerial) in consultation with a faculty member in an area related to electronics and computer technology or telecommunications. The student, along with the faculty member defines the problem's objectives and a solution is pursued. Prerequisite: Departmental Approval.

**ECT-755. Optical Communication Systems II****Credit 3 (2-2)**

This course is a continuation of ECT 655. The course will focus primarily on optical signal processing technologies as they are applied to high-speed communication systems. Prerequisite: ECT 655.

**ECT-759. Special Topics in Electronics and Computer Tech****Credit 3 (2-2)**

This course involves the study of a topic not addressed by an existing course in the department. Typically a topic is selected from within a new or evolving area in the field. Prerequisite: Departmental Approval.

**ECT-760. Wireless Communication Systems II****Credit 3 (2-2)**

The course will discuss the transmission of data over mobile links and digital packet data systems. The course will also address security and privacy issues in wireless communication systems. These topics will be introduced via in-depth case studies of wireless standards such as IS-41, GSM, PCS and third generation standards and technologies. Prerequisite: ECT 650 or ECT 660.

**ECT-770. Communication Circuit Development Laboratory II Credit 3 (1-4)**

This course is a continuation of ECT 670. The course will study practical methods of building a complete high frequency or ultra high frequency communication system at the discrete component level. Prerequisite: ECT 670.

**Construction Management****CM-603. Environmental Issues in Construction Technology****Credit 3 (3-0)**

The environmental issues that are facing the construction industry are studied. Issues include site management, water supply, storm water management, sewage disposal, solid and hazardous waste management and air and noise pollution. Emphasis will be placed on local and federal standards that impact upon construction projects. Prerequisite: Senior Standing.

**CM-617. Independent Study I****Credit 3 (3-0)**

Study is arranged on a special construction topic of interest to the student and faculty member who will act as an advisor. Prerequisite: Senior Standing.

**CM-618. Independent Study II****Credit 3 (3-0)**

Study is arranged on a special construction topic of interest to the student and faculty member who will act as an advisor. Prerequisite: Senior Standing.

**CM-650. Construction Contracts and Law****Credit 3 (3-0)**

This course deals with contracts and the law in regard to construction company formation, methods of advertising, bidding process, contract formation and awards. Special emphasis is placed on law pertaining to the construction industry. Extensive case studies are reviewed. Prerequisites: CM 317, 598. Senior Standing Required.



**CM-675. Advanced Construction Planning and Scheduling** **Credit 3 (2-3)**

Planning, scheduling and organizing of construction projects to control time costs and other resources are studied. Emphasis is on advanced preparation, analysis, control of network schedules and computer use with a variety of software packages. Prerequisite: CM 594.

**CM-678. Real Estate and Land Development** **Credit 3 (3-0)**

This course will provide an overview of land planning and development. A step-by-step description of the land development process and the relationship of each of the steps to the overall process will be the main focus of this course. Topics to be covered include regulatory and financial elements as they relate to: the development process such as zoning, floor area ratios, development bonus for amenities, zoning variances, building permits and inspections, real estate taxes, development districts, historic preservation, market feasibility, financial analysis management and leasing processes. Prerequisites: CM 215, 216, 596.

**CM-685. Graduate Internship I** **Credit 3 (3-0)**

This course is an internship experience in construction-related industries. A special project is required. Permission of the graduate advisor is required.

**CM-686. Graduate Internship II** **Credit 3 (3-0)**

This course is an internship experience in construction-related industries. A special project is required. Permission of the graduate advisor is required.

**CM-715. Productivity and Methods Improvement in Construction** **Credit 3 (3-0)**

Methods and techniques of analyzing construction work to improve productivity are studied. Total quality management, worker motivation, productivity ratings, crew balancing and work measurement are discussed and developed as models for change in the construction management process. Prerequisites: CM 710, Graduate Standing.

**CM-750. Research Methods in Construction** **Credit 3 (3-0)**

Fundamentals of construction research methods, techniques, research design, data collection and analysis with relevant computer applications are incorporated into the course. Prerequisite: ECON 305.

**Graphic Communications Systems and Technological Studies**

**GCS-601. Advanced Flexographic Methods** **Credit 3 (1-4)**

This course is designed to develop advanced proficiency in flexographic printing. It includes the prediction of future flexographic markets, products, substrates, inks, solvents, and industry standards for color processing.

**GCS-630. Multimedia and Videography** **Credit 3 (2-2)**

This course covers the development and utilization of multimedia presentations and videography in the educational environment. Topics include principles of composition, planning, editing, and producing multimedia presentations appropriate for educational or industrial settings. Computers and software packages will be used to develop the presentations.

**GCS-631. Advanced Computer-Aided Design** **Credit 3 (2-2)**

This course focuses on developing knowledge and skill with computer software used with solid modeling and the use of computer software to generate these models. Emphasis will also be placed on the creation of wire-frame and surface models. Analysis, fabrication and documentation of these models will be addressed.

**GCS-632. Graphic Animation****Credit 3 (2-2)**

This course deals with the creation and manipulation of computer generated geometric shapes and models. Topics include creation of 3D scenes, assignment of materials, lights and textures, keyframing, rendering, and animation.

**GCS-633. Advanced Machine Design and Drafting****Credit 3 (2-2)**

This course covers advanced drafting and design techniques associated with machine components and assembly. Topics include tool design and material selection, work-holding principles, design of jigs, fixtures and press working tools, inspection and gaging, joining processes, modular tooling, and economics of design.

**GCS-634. Advanced Multimedia and Videography****Credit 3 (2-2)**

This course provides advanced strategies and techniques in the development of multimedia presentations and videography. State of the art equipment will be used in addition to computers and software packages to produce professional presentations.

**GCS-635. Advanced Principles of Graphic Communications Technology****Credit 3 (2-2)**

Advanced principles in graphic reproduction. Study of color applications, photographic applications, design and pre-press techniques. Technical experiences in reproduction methods and quality control.

**GCS-636. Electronic Imaging in Distance Learning****Credit 3 (2-2)**

This course integrates the strategies and techniques of electronic imaging into distance learning applications. Areas of emphasis include Web page development and management unique to distance learning delivery systems for the internet.

**GCS-637. Industrial and Customer Relations in Graphic Communications****Credit 3 (3-0)**

This course focuses on industrial and customer relations within the field of graphic communications. Responsibilities and duties of the manager and his/her relationship to higher-level supervisors, subordinates, associates and customers are examined. Emphasis is placed on developing skills essential for persuasive communication.

**GCS-644. Advanced Architectural Drafting and Design****Credit 3 (2-2)**

This course covers advanced drafting and design techniques associated with the building industries. Topics include the development of working drawings, site plans, elevations, sections, and details in accordance with building codes. Upon completion the student should be able to plan and develop architectural drawings that comply with accepted architectural standards and procedures.

**GCS-667. Independent Studies in Technological Education I****Credit 3 (3-0)**

This course involves intensive study in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

**GCS-668. Independent Studies in Technological Education II****Credit 3 (3-0)**

This course involves intensive inquiry in the field of technological education under the direction of a faculty advisor. Prerequisite: Approval of graduate studies coordinator.

**GCS-670. Electronic Imaging in Graphic Communication****Credit 3 (2-2)**

Theory, principles and practices of electronic non-impact printing are investigated in class. Students will be given opportunities to explain, visit and utilize current non-impact printing systems through visits to industrial settings, classroom projects and special demonstrations.

**TECH-717. Special Problems I****Credit 3 (3-0)**

This course is an advanced study in modern technology that deals with recent developments, trends, practices and procedures in industries. Learning activities include individual and group research and experimentation involving selection, design, development, and evaluation of technical reports and instructional materials.

**TECH-718. Special Problems II****Credit 3 (3-0)**

Individual study related to modern technology including research and experimentation involving selection, design, development, and evaluation of instructional materials will be the focus of this course.

**TECH-719. Seminar in Computer Aided Drafting and Design** **Credit 3 (2-2)**

This course surveys the CADD software packages currently used in industrial and educational fields. It explores the uses and applications of these packages, and covers the transfer of data across platforms. Strengths of various software packages for special situations are emphasized.

**GCS-731. Advanced Graphical Techniques****Credit 3 (2-2)**

This course is designed to study the applications of American National Standards Institute (ANSI) and International Standards Organization (ISO) drafting standards, computer aided graphical problem solving techniques, drafting methods in certain specialty areas, and different conventions related to tolerancing. Use of literature and research is expected.

**GCS-733. Graphic Communications Organization and Management****Credit 3 (3-0)**

This course discusses formal and informal organizations, group dynamics, motivation, and managing conflict and change. Emphasis will be placed on different management practices and leadership styles as they relate to satisfaction and morale, organizational effectiveness, productivity, and profitability in the graphic communications industry.

**Occupational Safety and Health****OSH-600. Occupational Toxicology****Credit 3 (3-0)**

This course is a basic survey of the principles of toxicology. Emphasis will be placed on the effects of common industrial toxicants; absorption, distribution, secretion and bio-transformation of toxicants; and toxicological assay methods. Mechanisms of action, testing, risk assessment, carcinogenesis, oncogenes, receptors, toxicological evaluation, and host/environmental interactions will be discussed.

**OSH-613. Industrial Hygiene Ventilation****Credit 3 (3-0)**

This course will acquaint health and safety professionals with the principles of local and general ventilation systems. Topics covered include: basic terms and formula, hoods, design considerations, air cleaners, fans, exhaust system performance, dilution ventilation, comfort ventilation, make-up air requirements, indoor air quality standards and HVAC systems.

**OSH-630. Industrial Safety****Credit 3 (3-0)**

This course focuses on the industrial manager's role in preventing accidents, protecting workers health, and maintaining safety awareness in the workplace.

**OSH-632. Design of Engineering Hazard Controls****Credit 3 (2-2)**

This course is an overview of the design and assessment of engineering controls for the abatement of health and safety hazards in the work place. An emphasis is placed on cost benefit analysis, and technical and financial feasibility. Topics of discussion include industrial noise



abatement, industrial ventilation, machine guarding, and walking and working surfaces. Prerequisites: OSH 416, MFG 191, MFG 491.

### **OSH-637. Machine and Welding Safety**

**Credit 3 (3-0)**

This course is an introduction to machine guarding and welding safety. An emphasis is placed on the applicable standards of the Occupational Safety and Health Administration found in the Code of Federal Regulations. Prerequisite: OSH 312.

### **OSH-642. Electrical Safety**

**Credit 3 (3-0)**

This course is an overview of the identification and control of the fire and electrocution hazards of electrical wiring and equipment. An emphasis is placed on the National Electric Code and electrical standards of the Occupational Safety and Health Administration found in the Code of Federal Regulations. Prerequisites: OSH 312, PHYS 226 and 236 or equivalent.

### **OSH-672. Systems Safety and Other Analytical Methods**

**Credit 3 (3-0)**

This course is an overview of system theory and process safety management. An emphasis is placed on regulatory compliance with the process safety management standard of the Occupational Safety and Health Administration. Topics of discussion include fault tree analysis, failure modes, and risk analysis and management. Prerequisites: MATH 224 or equivalent, OSH 411.

### **OSH-678. Experiential Education I**

**Credit 3 (3-0)**

To satisfy the requirements of this course, students must engage in cooperative activities within the industry, government agencies, or consulting firms. Work responsibilities must include significant hazard assessment activities. Conditions of experience are supervised by department faculty.

### **OSH-679. Experiential Education II**

**Credit 3 (3-0)**

To satisfy the requirements of this course, students must engage in intern activities within industry, government agencies, or consulting firms. Work responsibilities must include significant hazard assessment activities. Conditions of experience are supervised by department faculty.

### **OSH-700. Special Problems in Occupational Health & Safety**

**Credit 3 (3-0)**

This course provides an opportunity to study special areas in the discipline. Course content will be determined by the Department and the instructor with a complete syllabus each time the course is offered.

### **OSH-704. Occupational Epidemiology**

**Credit 3 (3-0)**

The main focus of this course is on the fundamentals of occupational epidemiology, epidemiological methods used in both chronic and infectious occupational disease epidemiology, application of methods to safety and health research and practice will be stressed. Epidemiologic topics will also be related to subjects in occupational safety and health management.

### **OSH-706. Noise Control**

**Credit 3 (3-0)**

This course will cover the following topics: properties of sound, occupation damage-risk criteria, noise surveys and measuring equipment, noise control programs, and engineering controls.

### **OSH-712. Education and Training Methods for Safety**

**Credit 3 (3-0)**

Lectures with emphasis on education/training for the control or prevention of occupation injuries or illnesses. Education/training methods, materials and available courses are stressed. Student is expected to determine the need for education/training, design a program for a specific control effort, establish criteria for evaluation of the program.



**OSH-731. Toxicology for the Industrial Hygienist****Credit 3 (3-0)**

This course is a basic survey of the principles of toxicology. Emphasis will be placed on the effects of common industrial toxicants; absorption, distribution, secretion, and biotransformation of toxicants; and toxicological essay methods. Prerequisite: OSH 416 or approval of instructor.

**OSH-751. Industrial Ventilation****Credit 3 (3-0)**

This course is an introduction to the design of local exhaust ventilation systems for the control of airborne contaminants. An emphasis will be placed on the velocity pressure method of predicting system performance, and minimization of total installation and operational costs. Prerequisite: OSH 416 or approval of instructor.

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## Management Information Systems

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Paul G. Simmonds, Chairperson  
Room 315, Merrick Hall  
(336) 334-7656

The Department of Business Administration offers a program of study leading to the Master of Science in Management degree with a concentration in Management Information Systems (MIS). The program prepares students and professionals for careers in public and private sector positions in information systems management, or to apply MIS concepts to other business disciplines.

### DEGREE OFFERED

Master of Science in Management – Management Information Systems

### GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.60 (on a 4.0 scale), and a satisfactory GMAT score. Applicants who do not meet the requirements will be considered on an individual basis. A GPA of 3.0 is required for graduation.

### PROGRAM REQUIREMENTS

Students with a variety of undergraduate majors are encouraged to apply. The program is designed to appeal to those who either currently work in industry or desire to affiliate with firms or organizations using cutting-edge tools to deliver their products or services. Students in the program will have a business related undergraduate degree and wish to study a particular area in greater depth, or have a non-business related degree with the personal or professional interests or experiences that would be enhanced by a high quality graduate program in management education.

The program requires a minimum of 30 semester-hours. There is no thesis requirement. Students without an undergraduate business-related degree will be required to take appropriate foundation courses, which may extend the requirements to 42-45 semester-hours. The program consists of 18 hours of core courses, including one 3-hour elective, and 15 hours of coursework in the major concentration.

The student pursuing the Master of Science in Management is required to complete a common core of courses consisting of:

ACCT 714	Managerial Accounting & Finance	3 semester hours
BUAD 715	Quantitative Business Analysis	3 semester hours
BUAD 716	Strategic Marketing	3 semester hours
BUAD 718	Management & Organization Analysis	3 semester hours
ECON 608	Managerial Economics	3 semester hours

**ELECTIVE**

COMP 710	Software Specialization, Analysis & Design	3 semester hours
INEN 618	Total Quality Management	3 semester hours
INEN 658	Project Management	3 semester hours

**One course selected from the following:**

Courses in the MIS concentration will consist of the following courses:

BUAD 740	Management & Implementation of MIS	3 semester hours
BUAD 742	Telecommunication Systems Management	3 semester hours
BUAD 744	Enterprise Data Modeling	3 semester hours
BUAD 746	E-Business and E-Commerce	3 semester hours
BUAD 748	MIS Projects	3 semester hours

Students without an undergraduate business-related degree will be required to take appropriate foundation courses, which consist of the following.

ACCT 708	Seminar in Financial Concepts	3 semester hours
BUAD 705	Seminar in Business Analysis	3 semester hours
BUAD 712	Foundation of Enterprise Management	3 semester hours
ECON 706	Seminar in Economics	3 semester hours

**LIST OF GRADUATE COURSES**

Course	Description	Credit
ACCT 708	Seminar in Financial Concepts	3
ACCT 714	Managerial Accounting & Finance	3
BUAD 705	Seminar in Business Analysis	3
BUAD 712	Foundation of Enterprise Management	3
BUAD 715	Quantitative Business Analysis	3
BUAD 716	Strategic Marketing	3
BUAD 718	Management & Organization Analysis	3
BUAD 740	Management & Implementation of MIS	3
BUAD 742	Telecommunication Systems Management	3
BUAD 744	Enterprise Data Modeling	3
BUAD 746	E-Business and E-Commerce	3
BUAD 748	MIS Projects	3
ECON 608	Managerial Economics	3
ECON 706	Seminar in Economics	3

**COURSES WITH DESCRIPTION IN  
BUSINESS ADMINISTRATION****ECON-608. Managerial Economics****Credit 3 (3-0)**

This course will apply economic principles to decision-making in management. The basic tools and methods of analysis are derived mainly from microeconomics. Additional tools discussed include statistical methods, operations research, financial analysis, and decision-making theory that are applied to managerial decision-making problems. Particular emphasis will be placed on demand analysis, forecasting, pricing and output decisions, cost-benefit analysis, present value analysis, cost-benefit analysis, capital budgeting, risk analysis, and decision making under uncertainty.

**ECON-706. Seminar in Economics****Credit 3 (3-0)**

This course introduces basic microeconomic principles and their applications in business. Basic economic concepts, including marginal analysis of consumer and firm decisions, will be covered along with macroeconomic theories that support managers understanding of the global economic environment and the economic policies affecting that environment.

**BUAD-705. Seminar in Business Analysis****Credit 3 (3-0)**

This course will integrate the statistical and mathematical concepts that are essential for identifying, analyzing, and solving complex business problems. Business applications will involve investment, inventory, and capital budgeting analyses, utilizing computer spreadsheet models and the Visual Basic programming language.

**BUAD-712. Foundations of Enterprise Management****Credit 3 (3-0)**

This course provides an understanding of key themes related to successful enterprise management, and discussions of the interpersonal and intellectual skills necessary to contribute to a highly competitive and globalized business environment. Topics include the globalization of commerce, marketing and market systems, competitive strategy, perspectives on legal and ethical business conduct, information technology, and the elements of quality. Individual and team competencies are developed using materials that involve interpersonal skills, problem-solving, and case analysis.

**BUAD-715. Quantitative Business Analysis****Credit 3 (3-0)**

This course familiarizes students with basic quantitative techniques for decision-making in all business functions. Specific topics will include data collection and presentation; basic descriptive statistics and probability; discrete and continuous probability distributions; confidence intervals; hypothesis testing; business forecasting; linear and multiple regression models; linear, integer, and nonlinear programming; and computer simulation. Emphasis will be on the application of these techniques for managerial decision-making.

**BUAD-716. Strategic Marketing****Credit 3 (3-0)**

This course provides in-depth examination of the role of marketing in strategic planning and decision-making. Students develop skills critical to directing business-unit marketing strategy and designing or reengineering a customer-driven organization. The course content emphasizes cases and readings. It also exposes students to emerging issues in marketing strategy including relationship marketing and e-commerce.

**BUAD-718. Management and Organizational Analysis****Credit 3 (3-0)**

This course is a study of formal organizations as rational, organic, open systems and their behavior in response to an ever-changing, global and domestic environment. It covers macro and micro theories of management and organizations and their application to organizational design and processes. Organizational effectiveness, strategic planning and control, structural designs, leadership, motivation, globalization, and corporate politics and culture are studied through extensive reading, case studies, exploratory research and seminar discussions.

**BUAD-740. Management and Implementation of Enterprise Information Systems****Credit 3 (3-0)**

This is an applied course in concepts and techniques used in the design, development, and implementation of management information systems and decision support systems using systems design concepts and software development tools for web enabled applications. The implementation issues of organizational fit and organizational diffusion will be discussed along with security and ethics.



**BUAD-742. Telecommunications Systems Management****Credit 3 (3-0)**

This course provides in-depth coverage of data communications applications and the management of telecommunications hardware and software. Emphasis is on analysis and design of networking applications, management of telecommunications networks, and evaluation of connectivity options. Topics to be covered include: telecommunications devices, media systems, network hardware and software, network configuration, network applications, cost-benefit analysis, topologies and reliability. Students will work with assembling and testing networks in a network laboratory.

**BUAD-744. Enterprise Data Modeling****Credit 3 (3-0)**

From a business perspective, this course will analyze databases to facilitate surveillance and scanning for reverse competitive intelligence and for gathering data on customers and competitors. From an information perspective it will cover distributed databases, database integrity and security, data warehousing, data modeling tools, data dictionaries, and query language. Students will make extensive use of database systems.

**BUAD-746. E-Business and E-Commerce Management****Credit 3 (3-0)**

This course is a comprehensive overview of building and managing an e-business. Topics examined include: the decision to bring a business online, choosing a business model, developing a business plan, accepting payments, marketing strategies, and security. A complete web-based e-business storefront will be designed and developed based on a viable business model and marketing plan.

**BUAD-748. MIS Projects****Credit 3 (3-0)**

This course requires an applied project designed to provide students with the necessary skills to manage the development of technology-based solutions for opportunities faced by organizations today. Students gain practical experience in enabling change through the use of information technology. Students work in faculty-supervised teams with sponsoring businesses. Project deliverables include: analysis and evaluation of existing business processes, evaluation of alternatives for improvement, potential for IT work process improvement, demonstration of feasibility, and an implementation plan.

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## Mathematics

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The School of Graduate Studies through the Department of Mathematics offers two curricula leading to the Master of Science in Education. One is intended primarily for individuals who teach mathematics at the middle school or high school level and the other is intended for individuals who teach mathematics at the high school or two-year college level. In addition, it offers a program of studies leading to the M.S. degree in Applied Mathematics.

### DEGREES OFFERED

Mathematics, Secondary Education - Master of Science  
Applied Mathematics - Master of Science

### GENERAL ADMISSION REQUIREMENTS

Mathematics Education and Applied Mathematics students must follow the general admission requirements for graduate studies; Mathematics Education students must also satisfy the following criteria for admission to the program.

- A Bachelor's degree in Mathematics or a related field from an accredited institution.
- North Carolina "A" license in Secondary Mathematics or the equivalent from another state or eligibility to hold an "A" certification.
- An undergraduate GPA of 2.60 overall or 3.0 in the junior/senior years.
- Three (3) letters of recommendation.
- Official scores on GRE (Graduation Record Examination) or the MAT (Miller Analogies Test). Tests must be taken within the last five (5) years.

### DEPARTMENTAL REQUIREMENTS

In addition to meeting general requirements specified above, a student seeking admission to a graduate program in the Department of Mathematics must have earned thirty (30) semester hours in mathematics including differential and integral calculus, linear algebra and differential equations. A student who fails to meet these requirements will be expected to enroll in appropriate undergraduate courses before beginning his graduate studies in mathematics. A student may not receive graduate credit for a course that is equivalent to one for which he received a grade of "C" or above as an undergraduate.

### MATHEMATICS EDUCATION CURRICULUM

Students may select either the thesis or non-thesis option. Each option requires a total of thirty-nine (39) semester hours: fifteen (15) semester hours in Professional Education, twenty-one (21) semester hours in Mathematics, and three (3) semester hours of electives.

All Mathematics Education students must complete the core courses specified in the description of general requirements for a Master of Science in Education. The five (5) core Professional Education courses required are as follows:

Courses	Description
CUIN 619	Learning Theories
CUIN 711	Research and Inquiry
CUIN 721	Advanced Methods and Internship
CUIN 728	Technology Across the Curriculum
CUIN 729	Diversity

Each Mathematics Education student must complete at least one (1) course from each of the five (5) major areas of study. Students completing the **Middle School/High School Curriculum** must take a minimum of one (1) 700 level course in Mathematics. Students completing High-School-2 year College Curriculum must take a minimum if three (3) 700 level courses in Mathematics.

The five major areas of study include:

1. Algebra:

MATH 602	Modern Algebra
MATH 612	Advanced Linear Algebra
MATH 631	Linear and Non-Linear Algebra
MATH 665	Principles of Optimization
MATH 712	Numerical Linear Algebra
MATH 717	Special Topics in Algebra

2. Analysis:

MATH 603	Introduction to Real Analysis
MATH 610	Complex Variables I
MATH 611	Complex Variables II
MATH 620	Elements of Set Theory and Topology
MATH 650	Ordinary Differential Equations
MATH 651	Partial Differential Equations
MATH 700	Theory of Functions of a Complex Variable I
MATH 711	Theory of Functions of a Complex Variable II
MATH 720	Special Topics in Analysis
MATH 751	Solution Methods in Integral Equations
MATH 752	Calculus of Variations and Control Theory

3. Geometry:

MATH 604	Modern Geometry for Secondary School Teachers
MATH 715	Projective Geometry

4. Statistics:

MATH 608	Methods of Applied Statistics
MATH 623	Probability Theory and Applications
MATH 624	Theory and Methods of Statistics
MATH 706	Categorical Data Analysis
MATH 708	Nonparametric Statistics
MATH 721	Multivariate Statistical Analysis
MATH 731	Advanced Numerical Methods

5. Applications of Technology in Mathematics:

MATH 601	Technology and Applications in Secondary School Mathematics
MATH 608	Methods of Applied Statistics
MATH 624	Theory and Methods of Statistics

MATH 631	Linear and Non-Linear Programming
MATH 665	Principles of Optimization
MATH 706	Categorical Data Analysis
MATH 708	Nonparametric Statistics
MATH 712	Numerical Linear Algebra
MATH 721	Multivariate Statistical Analysis
MATH 731	Advanced Numerical Methods
MATH 765	Optimization Theory and Applications

#### Other Requirements:

1. Thesis or Research Project or Portfolio
2. Comprehensive Examination in Mathematics
3. Comprehensive Examination in Education

### APPLIED MATHEMATICS CURRICULUM

A student seeking the Master of Science in Applied Mathematics must complete the following:

1. At least fifteen semester hours of 700-level courses in either mathematics or an applications area of mathematics.
2. A minimum of eighteen semester hours of credit in the Department of Mathematics.
3. A thesis or a project.
4. A minimum of thirty semester hours of graduate credit.

#### Courses

MATH 600	Introduction to Modern Mathematics for Secondary School Teachers
MATH 601	Technology and Applications in Secondary School Mathematics
MATH 602	Modern Algebra
MATH 603	Introduction to Real Analysis
MATH 604	Modern Geometry for Secondary School Teachers
MATH 606	Mathematics for Chemists
MATH 607	Theory of Numbers
MATH 608	Methods of Applied Statistics
MATH 610	Complex Variables I
MATH 611	Complex Variables II
MATH 612	Advanced Linear Algebra
MATH 620	Elements of Set Theory and Topology
MATH 623	Probability Theory and Applications
MATH 624	Theory and Methods of Statistics
MATH 625	Mathematics for Elementary School Teachers I
MATH 626	Mathematics for Elementary School Teachers II
MATH 631	Linear and Non-Linear Programming
MATH 632	Games and Queueing Theory
MATH 633	Stochastic Processes
MATH 650	Ordinary Differential Equations
MATH 651	Partial Differential Equations
MATH 652	Methods of Applied Mathematics
MATH 665	Principles of Optimization
MATH 675	Graph Theory



MATH 691	Special Topics in Applied Mathematics
MATH 700	Theory of Functions of a Real Variable I
MATH 701	Theory of Functions of a Real Variable II
MATH 706	Categorical Data Analysis
MATH 708	Nonparametric Statistics
MATH 710	Theory of Functions of a Complex Variable I
MATH 711	Theory of Functions of a Complex Variable II
MATH 712	Numerical Linear Algebra
MATH 715	Projective Geometry
MATH 717	Special Topics in Algebra
MATH 720	Special Topics in Analysis
MATH 721	Multivariate Statistical Analysis
MATH 723	Advanced Topics in Applied Mathematics
MATH 725	Graduate Design Project
MATH 730	Thesis Research in Mathematics
MATH 731	Advanced Numerical Methods
MATH 751	Solution Methods in Integral Equations
MATH 752	Calculus of Variations and Control Theory
MATH 765	Optimization Theory and Applications
MATH 733	Advanced Probability and Stochastic Processes

## COURSES WITH DESCRIPTION IN MATHEMATICS

### Advanced Undergraduate and Graduate

#### **MATH-600. Introduction to Modern Mathematics for Secondary**

##### **School Teachers**

**Credit 3 (3-0)**

Elementary theory of sets, elementary logic and propositional systems, nature and methods of mathematical proofs, structure of the real number system. Open only to in-service teachers or to others having the permission of the Department of Mathematics.

#### **MATH-601. Technology and Applications in Secondary School**

##### **Mathematics**

**Credit 3 (3-0)**

This course covers techniques of teaching algebra, advanced algebra, trigonometry, and other secondary mathematics using graphing calculators, software packages and other technology. Prerequisite: Consent of the instructor.

#### **MATH-602. Modern Algebra**

**Credit 3 (3-0)**

This course covers mappings, binary operations, groups, rings, integral domains, fields, and some applications to coding and cryptography. Prerequisite: MATH 311 or consent of the instructor.

#### **MATH-603. Introduction to Real Analysis**

**Credit 3 (3-0)**

The following topics will be covered in this course: elementary set theory, functions, axiomatic development of the real numbers, metric spaces, convergent sequences, completeness, compactness, connectedness, continuity, limits, sequences of functions, differentiation, the mean value theorem, Taylor's theorem, Riemann integration, infinite series, the fixed point theorem, partial differentiation, and the implicit function theorem. Prerequisite: MATH-311 or consent of the instructor.

**MATH-604. Modern Geometry for Secondary School Teachers      Credit 3 (3-0)**

Re-examination of Euclidean geometry, axiomatic systems and the Hilbert axioms, introduction to projective geometry and other non-Euclidean geometries. Prerequisite: MATH-600 or consent of the Department of Mathematics.

**MATH-606. Mathematics for Chemists      Credit 3 (3-0)**

Review of those principles of mathematics involved in chemical computations and derivations from general chemistry through physical chemistry; topics covered include significant figures, methods of expressing large and small numbers, algebraic operations, trigonometric functions and an introduction to calculus.

**MATH-607. Theory of Numbers      Credit 3 (3-0)**

Divisibility properties of the integers, the Euclidean algorithm, congruences, diophantine equations, number-theoretic functions and continued fractions. Prerequisite: Twenty hours of college mathematics.

**MATH-608. Methods of Applied Statistics      Credit 3 (3-0)**

This course introduces the SAS programming language, and uses it in the analysis of variance, both single and multi-factor. It includes various methods of hypothesis testing and constructing confidence intervals. The course covers simple and multiple linear regression, including model building and variable selection techniques. Elements of time series and categorical data analysis are covered. Prerequisite: MATH-224.

**MATH-610. Complex Variables I      Credit 3 (3-0)**

The following topics will be covered in this course: complex number system, limits of complex sequences, complex functions, continuity, limits of functions, derivatives, elementary functions, Cauchy-Riemann equations, antiderivatives harmonic functions, inverse functions, power series, analytic functions, analytic continuation, contour integrals, Cauchy's theorem and Cauchy's integral formula. Prerequisite: MATH-231.

**MATH-611. Complex Variables II      Credit 3 (3-0)**

MATH-611 is a continuation of MATH-610. The following topics will be covered in this course: Liouville's theorem, the fundamental theorem of algebra, the winding number, generalized Cauchy theorems, singularities, residue calculus, Laurent series, boundary value problems, harmonic functions, conformal mappings, Poisson's formula, potential theory, physical applications and the Riemann mapping theorem. Prerequisite: MATH-610.

**MATH-612. Advanced Linear Algebra      Credit 3 (3-0)**

This course covers vector spaces, linear transformations and matrices determinants and systems of linear equations, eigenvalues and eigenvectors, diagonalization, inner products, bilinear quadratic forms, canonical forms, and application to engineering and applied sciences. Prerequisite: MATH-450 or consent of the instructor.

**MATH-620. Elements of Set Theory and Topology      Credit 3 (3-0)**

Operations on sets, indexed families of sets, products of sets, relations, functions, metric spaces, general topological spaces, continuity, compactness and connectedness. Prerequisites: MATH-231 and consent of the instructor.

**MATH-623. Probability Theory and Applications      Credit 3 (3-0)**

This course begins with an introduction to sample spaces and probability, including combinatorics. It covers continuous and discrete random variables, including multivariate, random variables and expectations; also marginal and conditional distributions are derived. The course introduces moment generating functions, and covers the central limit theorem and its applications. Prerequisite: MATH-231.

**MATH-624. Theory and Methods of Statistics** **Credit 3 (3-0)**

This course introduces methods of statistical estimation and inference including the following topics: sufficient statistics, confidence sets, hypothesis tests, and maximum likelihood methods. The theory of uniformly most powerful tests and the Neyman-Pearson Lemma are covered. Other topics include least squares estimation, the linear model, and Bayesian methods. Prerequisite: MATH-623.

**MATH-625. Mathematics for Elementary Teachers, K-8, I** **Credit 3 (3-0)**

Designed for in-service and prospective teachers who have as their goal "to teach the basic skills and competencies of mathematics sought in today's world." The course emphasizes that the teacher, first, must have the knowledge and skills in order to accomplish this goal. It stresses fundamentals of arithmetic, sets and operations, number systems, fractions, decimals, percents, estimation, consumer arithmetic, problem solving and traditional and metric geometry and measurement. This course may not be used for degree credit.

**MATH-626. Mathematics for Elementary Teachers, K-8, II** **Credit 3 (3-0)**  
**(Formerly 3686)**

A continuation of MATH-625. No credit towards a degree in mathematics; not open to secondary school teachers of mathematics. Credit on elementary education degree. Prerequisite: MATH-625.

**MATH-631. Linear and Non-Linear Programming** **Credit 3 (3-0)**

Optimization subject to linear constraints; transportation problems; simplex method, network flows, applications of linear programming to industrial problems and economic theory. Introduction to non-linear programming. Prerequisites: MATH-450 and consent of the instructor.

**MATH-632. Games and Queue Theory** **Credit 3 (3-0)**

General introduction to game theory; two-person-non-zero-sum-non-cooperative games; two-person cooperative games; reasonable outcomes and values; the minimax theorem. Introduction to queuing theory; single server queuing processes; many serve queuing processes; applications to economics and business. Prerequisites: MATH-224, MATH-450 or consent of the instructor.

**MATH-633. Stochastic Processes** **Credit 3 (3-0)**

This course begins with a review of Probability and Random Variables. Markov Processes, Poisson Processes, Waiting Times, Renewal Phenomena, Branching Processes, Queuing System, Service Times are covered. Prerequisite: MATH-623 or consent of the instructor.

**MATH-650. Ordinary Differential Equations** **Credit 3 (3-0)**

This is an intermediate course in ordinary differential equations with emphasis on applications. Topics include linear systems and various phase plane techniques for non-linear ordinary differential equations. Prerequisite: MATH-431.

**MATH-651. Partial Differential Equations** **Credit 3 (3-0)**

This course includes introduction to complex variables and residue calculus, transform calculus, higher order partial differential equations governing various physical phenomena, non-homogeneous boundary value problems, orthogonal expressions, Green's functions and variational principles. Prerequisites: MATH-431, 432.

**MATH-652. Methods of Applied Mathematics** **Credit 3 (3-0)**

This course covers matrix theory, systems of linear equations, vector spaces, eigenvalue problem and its applications to systems of linear ODEs and mechanical vibrations, the simplest problems of calculus of variations, Euler equations, boundary conditions, extensions of Euler

equations, Hamilton's Principles, constraints and Lagrange multipliers, introduction to integral equations, and solutions in iterative and other methods. Prerequisites: MATH 431, 432.

**MATH-665. Principles of Optimization** **Credit 3 (3-0)**

Algebra, linear inequalities, duality, graphs, transport networks; linear programming; special algorithms; selected applications. An upper level course. Prerequisites: MATH-231 or equivalent and MATH-450.

**MATH-675. Graph Theory** **Credit 3 (3-0)**

Varieties of graphs, graph theory algorithms, and applications of graph theory to other disciplines. Prerequisite: MATH-450.

**MATH-691. Special Topics in Applied Mathematics** **Credit 3 (3-0)**

Topics are selected from differential equations, numerical methods, operations research, applied mechanics and from other fields of applied mathematics. Prerequisites: Senior or graduate standing and consent of the instructor.

**Graduate Students Only**

**MATH-700. Theory of Functions of a Real Variable I** **Credit 3 (3-0)**

The focus of this course is a careful study of the fundamental theorems of Lebesgue theory, including Lebesgue measure, differentiation and integration on the real line. Topics from set theory and point set topology are also included in this course. Prerequisite: MATH-507 or equivalent.

**MATH-701. Theory of Functions of a Real Variable II** **Credit 3 (3-0)**

This course is a continuation of MATH-700. The following topics will be covered in this course: general measure and integration, measure and outer measure, and some basic topics from functional analysis. Prerequisite: MATH-700.

**MATH-706. Categorical Data Analysis** **Credit 3 (3-0)**

This course will include the following topics: Two-Way Contingency Table Inference for Two-Way Table, Models for Binary Response Variables, Log-linear Models, Testing in Loglinear Models, Multinomial Response Models and Estimation Theory for Parametric Models, and Computer Analysis of Categorical Data. Prerequisite: MATH 624.

**MATH-708. Nonparametric Statistics** **Credit 3 (3-0)**

The following topics will be discussed in this course: Order Statistics, Run Test for Trend, Goodness of Fit Tests, Rank Tests for One and Two Populations, Linear Rank Statistics, One and Two Way Nonparametric Analysis of Variance, and applications to practical problems. Prerequisite: MATH 624.

**MATH-710. Theory of Functions of a Complex Variable I** **Credit 3 (3-0)**

This course includes basic theory of analytic functions, including Cauchy's theorem, conformal mappings, Taylor and Laurent series, and residue theory. Prerequisite: MATH-507 or equivalent.

**MATH-711. Theory of Functions of a Complex Variable II** **Credit 3 (3-0)**

This course is a continuation of MATH-710. Basic theory and applications of conformal mappings, fractional linear, analytic continuation, and Riemann surfaces will be covered in this course. Prerequisite: MATH-710.



**MATH-712. Numerical Linear Algebra** **Credit 3 (3-0)**

Numerical analysis for solution of linear systems, approximation methods for eigenvalues and eigenvectors, least squares solutions, ill-posed and ill-conditioned systems and error analysis are covered. Prerequisite: One programming language, MATH-450 or equivalent.

**MATH-715. Projective Geometry** **Credit 3 (3-0)**

A study of non-Euclidean geometry dealing with ordinary points, ideal points, ordinary lines, ideal lines, ordinary planes and ideal planes. The course deals with perspectivities and projectivities, harmonic sets of points and lines, dualities and related items in a non-metric setting. Prerequisites: Graduate standing and consent of the instructor.

**MATH-717. Special Topics in Algebra** **Credit 3 (3-0)**

This course covers selected topics in algebra. Topics covered will be determined by the instructor. Prerequisites: Consent of the instructor and graduate standing.

**MATH-720. Special Topics in Analysis** **Credit 3 (3-0)**

This course covers selected topics in analysis. Topics covered will be determined by the instructor. Prerequisites: Consent of the instructor and graduate standing.

**MATH-721. Multivariate Statistical Analysis** **Credit 3 (3-0)**

Multivariate Normal Distribution, Inference About a Mean Vector, Comparison of Several Multivariate Means, Analysis of Covariance Structure, Analysis of Dispersion, Classification and Clustering Techniques and Some Applications of Multivariate Tests will be discussed in this course. Also, practical examples of industrial use will be addressed. Prerequisites: MATH 608 and MATH 624.

**MATH-723. Advanced Topics in Applied Mathematics** **Credit 3 (3-0)**

This course is designed to cover important topics in applied mathematics that may be desired from time to time for specific students in the graduate program. It may also be used as a vehicle for development of new courses for graduate program students. Prerequisite: Consent of the instructor.

**MATH-725. Graduate Design Project** **Credit 3 (3-0)**

This course requires independent project work on an advanced mathematical topic of interest to the student and a faculty member acting as the student's advisor. The topic must be approved by the advisor. Prerequisite: Consent of the instructor.

**MATH-730. Thesis Research in Mathematics** **Credit 3 (3-0)**

Students who select the thesis option must do advanced research in an area of interest. The research topic must be approved by the thesis advisor.

**MATH-731. Advanced Numerical Methods** **Credit 3 (3-0)**

This course covers numerical methods for solution of parabolic, elliptic and hyperbolic boundary value problems. Problems are selected from engineering applications. Both finite difference and finite element methods are studied. Prerequisite: MATH-460 or equivalent.

**MATH-733. Advanced Probability and Stochastic Processes** **Credit 3 (3-0)**

The following topics will be discussed in this course: introduction to Lebesgue integration, probability theory and random variables, laws of large numbers, central limit theorems, random walks, martingales, Markov processes and Markov chains, ergodic theorems and Brownian motion. Prerequisite: MATH 603 or permission of the instructor.

**MATH-751. Solution Methods in Integral Equations** **Credit 3 (3-0)**

This course includes an introduction to integral equations, including Volterra equations, Fredholm equations, symmetric kernels, orthogonal systems of functions, and types of singular and

non-linear integral equations. Applications to engineering areas are also discussed. Prerequisites: MATH-431, MATH-432 or equivalent.

**MATH-752. Calculus of Variation and Control Theory** **Credit 3 (3-0)**

This course covers the following topics: Functionals, Euler's equation, Lagrange multipliers, Kuhn-Tucker conditions, Pontryagin maximum principle, Weierstrass-Erdmann corner conditions, Euler-Lagrange equations; first and second variational problems. Applications to engineering areas will also be included. Prerequisites: MATH-431, MATH-432 or equivalent.

**MATH-765. Optimization Theory and Applications** **Credit 3 (3-0)**

Gradient methods for unconstrained optimization, constrained nonlinear optimization, optimization of multi-steps, variational principles, and applications relating to business and engineering are discussed. Prerequisites: MATH-450, MATH-431, MATH-432.

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## Mechanical Engineering

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### OBJECTIVES OF THE PROGRAM

The objective of graduate study in Mechanical Engineering is to provide advanced level study in mechanical engineering in four distinct areas of specialization. The Master of Science in Mechanical Engineering is designed to prepare the graduate for Ph.D. level studies or for advanced mechanical engineering practice in industrial consulting or government service. The Ph.D. degree in Mechanical Engineering provides both advanced instruction and independent research opportunities to students. The Ph.D. degree is the highest academic degree offered, and graduates typically are employed in research environments in government laboratories and industries, and as university faculty.

### DEGREES OFFERED

Mechanical Engineering - Master of Science (MSME)  
Mechanical Engineering - Doctor of Philosophy (Ph.D.)

### MASTER OF SCIENCE IN MECHANICAL ENGINEERING

#### Program Description

The Master of Science in Mechanical Engineering is graduate-level program comprised of advanced classroom and independent study courses in mechanics and materials, energy and thermal/fluid systems, design and manufacturing, and aerospace.

#### Admission to the MSME Program

The Master of Science in Mechanical Engineering Program is open to students with a Bachelor's Degree in Mechanical Engineering or a closely related field from an institution of recognized standing. In order to pursue a graduate degree in Mechanical Engineering, an applicant must first be admitted to the School of Graduate Studies. The initial step toward graduate admission is to complete the required application forms and submit them to the School of Graduate Studies Office. In addition to the application forms, two copies of the student's undergraduate and/or graduate transcript(s) and two recommendation letters are required. Processing of applications cannot be guaranteed unless they are received, with all supporting documents and application fee payment, in the School of Graduate Studies. Applicants should note all application deadline dates. Submission of application materials after the deadline for applications will delay consideration by one or more academic semesters. Foreign Nationals are encouraged to apply at least two months in advance of each admission deadline date. Foreign Nationals must also file a Financial Certification Form and Certification of Sources of Funds and Amounts. Specific information regarding visa and immigration requirements can be obtained from the Office of International and Minority Student Affairs, North Carolina A&T State University, Murphy Hall, Room 221, Greensboro, NC 27411. Application packages may

be obtained from the School of Graduate Studies Office, Room 122, Gibbs Hall, North Carolina A&T State University, Greensboro, NC 27411.

Applicants may be admitted to the MSME Program under three categories: Unconditional Admission, Conditional Admission, or Special Student (Undergraduate) Admission. Details follow:

1. *Unconditional Admission:* An applicant may be given unconditional admission to the MSME Program if he/she possesses a MSME bachelors degree from an ABET (Accreditation Board for Engineering and Technology) accredited institution, with an overall GPA of 3.0 or better on a 4.0 scale.

Students admitted on an unconditional basis are also expected to have completed "key courses" below as part of their prior undergraduate program.

Undergraduate Courses Required:

Calculus (minimum of 8 semester hours)	Statics
Differential Equations	Dynamics
Applied Engineering Mathematics	Strength of Materials
Physics (minimum of 6 semester hours)	Materials Science
Chemistry	Thermodynamics
Fortran Programming	Fluid Mechanics
Introductory Numerical Methods	Machine Design or Equivalent

Additional undergraduate course requirements for Specialization in Mechanics and Materials: three credits of Advanced Materials

Additional undergraduate course required for Specialization in Energy and Thermal/Sciences: three credits of Heat Transfer

Additional undergraduate courses required for Specialization in Design and Manufacturing: three credits of Kinematics and three credits of Manufacturing Processes

2. *Provisional Admission:* Applicants may be granted conditional admission if they do not qualify for unconditional admission due to one or more of the following reasons:

- a. Applicant has a baccalaureate mechanical engineering degree from a non-ABET accredited program. Undergraduate engineering degrees from foreign universities fall into this category.

- b. Applicant has a baccalaureate degree in engineering but is deficient in key background courses listed in the previous section. These deficiencies must not exceed 12 credit hours.

- c. Applicant has an undergraduate degree which is not in engineering but is in a closely related curriculum with a substantial engineering science content. Background deficiencies should not exceed 12 credit hours.

- d. Applicant's undergraduate grade point average is below that required for unconditional admission but there is also academic evidence that the student will successfully complete the degree.

Provisional admission status will be changed to unconditional when the student has satisfied the two conditions below:

- a. All required course deficiencies have been completed with a 3.0 GPA or above and
- b. A minimum of a 3.0 GPA is attained on A&T courses taken for graduate credit at the end of the semester in which the 9th semester credit is completed.

Failure to move to unconditional admission when first eligible will result in the student's being subject to probation policies. Other admission conditions and program requirements may be imposed on a case-by-case basis as approved by the Dean of the School of Graduate Studies.



Provisional admission status is the minimum level of graduate admission classification. In this classification, students are eligible to register for 700-level courses, provided such courses are approved by the academic advisor.

3. **Special Student (Undergraduate):** Special student admission implies that the student does not meet the above requirements for graduate admission in engineering. Students who hold an undergraduate degree but have course work deficiencies exceeding 12 credits may fall in the Special Student category. This category is reserved for candidates who, in spite of deficiencies in excess of 12 credits, show high potential, and will be able to remove these deficiencies in one calendar year of full-time study.

Special Student (Undergraduate) status will be changed to provisional admission status when the student:

- a. reduces the number of deficiencies to 12 credits or less,
- b. achieves a GPA of 3.0 or more in courses completed to remove deficiencies, and
- c. obtains an average grade of 3.0 or more in graduate courses completed.

Persons admitted as special students are limited to no more than six 600 level graduate credits while in this category — See Transfer of Credit below. Students classified under the Special Student (Undergraduate) category are subject to the undergraduate academic policies in effect at the time of admission.

## **Change of Admission Status**

It is the student's responsibility to apply to the department for a change in admission status. Students who fail to have their status upgraded run the risk of not receiving graduate credit for any completed graduate courses. Such students also run the risk of academic probation and dismissal.

## **Program Options**

### **1. Coursework Option**

This option consists of thirty-three (33) semester hours of coursework. Successful completion of the comprehensive examination is a degree requirement. Approval must be obtained from the Graduate Program Coordinator to elect the coursework option. A Coursework Option student must also take at least five courses from her/his specialization area or in a related area as specified by the academic advisor. A candidate who chooses the coursework option must select a permanent advisor who will direct the course of study and who will plan the Final Comprehensive Examination. The advisor may also be part of the group of examiners who conduct the Final Comprehensive Examination. A candidate who selects this option does not have a formal advising committee. See page 234 for a list of courses by specialization.

### **Comprehensive Examination (Coursework Option)**

Candidates who elect the coursework option must sit for a written comprehensive examination of six (6) hours duration, prepared as three independent two-hour examinations. A student must have completed at least twenty-one (21) hours of coursework to be eligible to take the comprehensive examination.

One week each semester, at least forty-five (45) days prior to the end of the semester, will be designated as Comprehensive Examination Week. All students wishing to take the examination must do so during this period.

Applications to take the examination must be submitted by the academic advisor to the Graduate Program Coordinator at least thirty (30) days prior to the scheduled beginning

date of the examination. The student must initiate this process by contacting his/her advisor with an examination request.

The application should contain a description of the subject areas to be covered by the exam. In consultation with the academic advisor, the Graduate Coordinator assigns an appropriate group of examiners as well as a test time and date. The Graduate Program Coordinator will organize the examination to arrange for as much "common" testing as possible based on material relating to the student's coursework.

The candidate must achieve a satisfactory score in at least two (2) sessions of the examination. A candidate who fails to achieve a satisfactory score at the first attempt may sit again in the next regularly scheduled Comprehensive Examination Week, generally in the following semester. A Candidate who fails a second time must petition the Dean of the School of Graduate Studies for permission to sit again. An unfavorable decision will result in dismissal from the program. A third failure will always result in dismissal from the program.

## **2. Project and Thesis Options**

The Project Option consists of thirty (30) semester hours of coursework and three (3) hours of special project. It is intended for students with an interest in research or independent study but who do not wish to do a full Master's thesis. Project Option students must take three hours of MEEN-766 Graduate Projects. An oral examination project defense/examination is required.

The Thesis Option consists of twenty-four (24) semester hours of course work and six (6) hours of thesis. Thesis Option students must take six hours of MEEN-777 Thesis. An original research topic must be chosen in conjunction with the student's advisor culminating in the preparation of a scholarly thesis. An oral thesis defense/examination is required. This option is intended for students with strong research interests who may desire to pursue further graduate studies towards a Ph.D. degree.

# **THE DOCTOR OF PHILOSOPHY IN MECHANICAL ENGINEERING**

## **Program Description**

The Ph.D. degree in Mechanical Engineering provides both doctoral-level instruction and independent research opportunities for students. The Ph.D. degree is the highest academic degree offered, and graduates typically are employed in research environments in government laboratories and industries, and as University faculty.

The Ph.D. degree program is highly individualistic in nature, and the student is expected to make a significant contribution to the reservoir of human knowledge by investigating a significant topic within the domain of mechanical engineering. A successful dissertation is the expected outcome of the degree program. The Ph.D. student must rely heavily on the guidance of the academic advisor and on the academic committee in formulating a plan of work, in setting and meeting the degree goals, and in selecting a dissertation problem. The academic advisor serves to guide the student during the dissertation study phase of the program.

For details concerning admission requirements, see Admission and Other Information elsewhere in this catalog.

## **Ph.D. Program Policies and Requirements**

The doctorate symbolizes the ability of the recipient to undertake original research and scholarly work of the highest levels without supervision. The degree is therefore not granted

simply upon completion of a stated amount of course work but rather upon demonstration by the student of a comprehensive knowledge and high attainment in scholarship in a specialized field of study. As a guide however, the student is expected generally to have completed at least twenty-four course credits beyond the master's degree and a minimum of twelve dissertation credits. The student must demonstrate both the attainment of scholarship and independent study in a specialized field of study by writing a dissertation reporting the results of an original investigation. The student must pass a series of comprehensive examinations in the field of specialization and related areas of knowledge and defend successfully the quality, methodology, findings, and significance of the dissertation.

### **Advisory Committee and Plan of Graduate Work**

An advisory committee of at least four graduate faculty members, one of whom will be designated as chair, will be appointed by the Dean of Graduate School upon the recommendation of the Chairperson of the department. The committee, which must include at least one representative of the minor field, will, with the student, prepare a Plan of Graduate Study which must be approved by the department and the School of Graduate Studies. In addition to the course work to be undertaken, the subject of the student's dissertation must appear on the plan; and any subsequent changes in committee or subject or in the overall plan must be submitted for approval as with the original plan.

The program of study must be unified, and all constituent parts must contribute to an organized program of study and research. Courses must be selected from groups embracing one principal subject of concentration, the major, and from a cognate field, the minor. Normally, a student will select the minor work from a single discipline or field. If advisory committee finds that the needs of the student will be best served by work in an interdisciplinary minor, it has the alternative of developing a special program in lieu of the usual minor.

### **CO-MAJOR**

There is currently two approved doctoral level programs of study on campus, Electrical and Industrial Engineering. Students may currently co-major through it or through the interinstitutional Ph.D. program. This would require the approval of both departments in the College of Engineering or through both university campuses, and approval of the students combined advisory committee. Co-majors must meet all requirements for majors in both departments. Only one degree is awarded and the co-major is noted on transcript. A co-major must involve degree programs and similar requirements. Co-majors are not permitted between Doctorate-level and lower level programs.

### **OTHER INFORMATION**

See "Requirements for the Doctor of Philosophy Degree" elsewhere in this catalog for information related to residence requirements, qualifying examination, preliminary examination, comprehensive examination, final oral examination, admission to candidacy, and time limit. Students should also consult the department handbook for more details.

### **THE DISSERTATION**

The doctoral dissertation presents the results of the student's original investigation in the field of major interest. It must be a contribution to knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected.

The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the School of Graduate Studies. Three copies of the document signed by all members of the student's advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by the School of Graduate Studies to ensure that the format conforms to its specifications.

The University has a requirement that all doctoral dissertations be microfilmed by University Microfilms International of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the micro-filming service.

Course	Title
MEEN 858	Mechanical Metallurgy
MEEN 860	Fracture Mechanics

#### Energy and Thermal/Fluid Systems

MEEN 626	Advanced Fluid Dynamics
MEEN 655	Computational Fluid Dynamics
MEEN 656	Boundary Layer Theory
MEEN 731	Conduction Heat Transfer
MEEN 732	Convection Heat Transfer
MEEN 734	Special Topics in Applied Heat Transfer
MEEN 820	Advanced Classical Thermodynamics
MEEN 822	Statistical Thermodynamics
MEEN 824	Irreversible Thermodynamics
MEEN 833	Radiation Heat Transfer
MEEN 838	Solar Thermal Energy Systems

#### Mechanical Systems

MEEN 619	Computer Aided Design of Mechanical Systems
MEEN 642	Materials Joining
MEEN 645	Aluminum Product Design and Manufacturing
MEEN 646	Advanced Manufacturing Processes
MEEN 647	Advanced Mechanism Design
MEEN 648	Computer Controlled Manufacturing
MEEN 649	Design of Robot Manipulators
MEEN 719	Advanced Computer-Aided Design
MEEN 742	Tools, Jigs, and Fixtures
MEEN 840	Machine Tool Design
MEEN 846	Stochastic Modeling of Mechanical Systems
MEEN 848	Digital Control of Machines and Processes
MEEN 849	Computer Control of Robot Manipulators



## MECHANICAL ENGINEERING COURSE DESCRIPTIONS

### **MEEN-602. Advanced Strength of Materials**

**Credits 3 (3-0)**

Stress-strain relations as applied to statically indeterminate structures, bending in curved bars, plates, shells, and beams on elastic foundations; strain energy concepts for formulation of flexibility matrix on finite elements; bending in beams and plates, introduction to Cartesian tensor notation and matrix structural analysis. Prerequisites: MEEN 336, MATH 332 or equivalent.

### **MEEN-604. Intermediate Dynamics**

**Credits 3 (3-0)**

Review of particle and system dynamics, then introduction to rigid body dynamics with solution techniques for the non-linear systems of ordinary differential equations as initial value problems. Angular and linear momentum, energy and Lagrangian methods of body problems. Generalized variables, small vibrations, gyroscopic effects and stability. Prerequisites: MEEN 337, MATH 332 or equivalent.

### **MEEN-608. Experimental Stress Analysis**

**Credits 3 (3-0)**

Principles and methods of experimental stress analysis. Photo-elastic and micromerement techniques applied to structural models; student project work. Prerequisites: AREN 457 or MEEN 602 or equivalent.

### **MEEN-610. Theory of Elasticity**

**Credits 3 (3-0)**

Introduction; stress; strain-strain relations; energy principles; special topics. Prerequisites: MATH 332 and MEEN 336 or equivalent.

### **MEEN-613. Composite Materials**

**Credits 3 (2-2)**

This course introduces the basics of processing of fiber-reinforced composite materials, anisotropic theory, and test methods for composites. Topics include different methods of processing polymeric composites, process control parameters, anisotropic constitutive equations, classes of anisotropy and associated elastic constants, micromechanics models, theories of failure, test methods, classical laminate theory, and special types of laminates. The concepts are applied to the design of simple composite structural components. This course includes a laboratory component for students to learn processing and testing of composite materials. Prerequisites: MEEN 260 and MEEN 336 or their equivalents.

### **MEEN-614. Mechanics of Engineering Modeling**

**Credits 3 (3-0)**

Engineering modeling techniques including time dependent integration simulation models of systems, finite difference and finite element methods in mechanics. Prerequisites: MEEN 210, MEEN 336, MATH 332 or equivalent.

### **MEEN-618. Numerical Analysis for Engineers**

**Credits 3 (3-0)**

Scientific programming, error analysis, matrix algebra, eigenvalue problems, curve-fitting approximations, interpolation, numerical differentiation and integration, solutions to simultaneous equations, and numerical solutions of differential equations. Prerequisite: MEEN 210 or equivalent.

### **MEEN-619. Computer Aided Design of Mechanical Systems**

**Credits 3 (3-0)**

This course covers computer graphics and design principles. Applications of various graphics and computational tools for the design of mechanical systems will be emphasized and discussed. Individual and group design projects will be given to illustrate the application of these techniques to real problems. Prerequisites: MEEN 210, MEEN 440, and MEEN 474.

- MEEN-626. Advanced Fluid Dynamics** **Credits 3 (3-0)**  
 Derivation of Navier-Stokes Equations, continuity equation and energy equation; exact solutions of Navier-Stokes Equations, inviscid flow, potential theory, complex potentials and conformal mapping. Prerequisite: MEEN 416 or equivalent.
- MEEN-642. Materials Joining** **Credits 3 (3-0)**  
 Theory and application of joining of metals, ceramics, and plastics by the standard industrial techniques, arc, gas, electron beam, laser ultrasonic, diffusion bonding. Principles of the use of phase diagrams, diffusion equations, and physical/chemical properties in joining considerations. Prerequisites: MEEN 226 and MATH 332 or equivalent.
- MEEN-645. Aluminum Product Design and Manufacturing** **Credits 3 (3-0)**  
 This course introduces students to the principles of product and manufacturing process design specifically applicable to aluminum-based materials. Material properties of aluminum are compared with those of other commercial materials. Raw material fabrication and product manufacturing processes are presented. The interactions between processes and material properties are described. Case studies are presented to guide the student in successful completion of design projects. Prerequisites: MEEN 260 and MEEN 474.
- MEEN-646. Advanced Manufacturing Processes** **Credits 3 (3-0)**  
 Theory, application, and design considerations for forming and machining. Machines and tooling in modern manufacturing processes. Dimensional and tolerance analysis. Control of work piece and tool. Projects in the design of molds, dies, presses, jigs and fixtures and automated machinery. Prerequisites: MEEN 226 or equivalent, MEEN 564, MATH 231.
- MEEN-647. Advanced Mechanism Design** **Credits 3 (3-0)**  
 Advanced synthesis techniques; kineto-static and dynamic issues in design of mechanisms. Use of digital simulations for design of mechanisms. Design projects are assigned to illustrate the applications of these techniques. Prerequisite: MEEN 440.
- MEEN-648. Computer Controlled Manufacturing** **Credits 3 (3-0)**  
 Concepts of Computer Integrated Manufacturing, Numerical Control and Group Technology. Manufacturing process interfacing, discrete process modeling, analysis and control techniques and algorithms. Characteristics and software of control computers. Sensors for computer control. Programmable controllers and sequential control. Prerequisites: MEEN 226, MATH 331, or consent of the instructor.
- MEEN-649. Design of Robot Manipulators** **Credits 3 (3-0)**  
 Fundamentals of kinematics, dynamics, computer graphics, sensing devices, measurements and control in robot manipulators. Prerequisites: MEEN 440, MEEN 619 or equivalent.
- MEEN-650. Mechanical Properties and Structure of Solids** **Credits 3 (3-0)**  
 An examination of the elastic and plastic behavior of matter in relation to its structure, both macroscopic and microscopic. Major representative classes of materials to be examined are thermoplastic materials, elastomers, glasses, ceramics, metals, and composites. Prerequisite: MEEN 560 or equivalent.
- MEEN-651. Aero Vehicle Structures II** **Credits 3 (3-0)**  
 This course covers deflection of structures, indeterminate structures, fatigue analysis, and minimum weight design. Finite element methods and software are utilized. Prerequisite: MEEN 422.

**MEEN-652. Aero Vehicle Stability and Control** **Credits 3 (3-0)**

This technical elective course covers longitudinal, directional, and lateral static stability and control of aerospace vehicles. It also covers linearized dynamics analysis of the motion of a six degree of-freedom flight vehicle in response to control inputs and disturbance through the use of the transfer function concept, plus control of static and dynamics behavior by vehicle design (stability derivatives) and/or flight control systems. Prerequisites: MEEN 415, MEEN 422, and ELEN 410.

**MEEN-653. Aero Vehicle Flight Dynamics** **Credits 3 (3-0)**

This technical elective course covers the basic dynamics of aerospace flight vehicles including orbital mechanics, interplanetary and ballistic trajectories, powered flight maneuvers and spacecraft stabilization. Prerequisites: MATH 332, MEEN 337, and MEEN 422.

**MEEN-654. Advanced Propulsion** **Credits 3 (3-0)**

This technical elective is a second course in propulsion. It covers the analysis and design of individual components and complete air-breathing propulsion systems including turbo fans, turbo jets, ram jets, and chemical rockets. Prerequisite: MEEN 576.

**MEEN-655. Computational Fluid Dynamics** **Credits 3 (3-0)**

This technical elective course provides an introduction to numerical methods for solving the exact equations of fluid dynamics. Finite difference methods are emphasized as applied to viscous and inviscid flows over bodies. Students are introduced to a modern computational fluid dynamics computer code. Prerequisites: MATH 332 and MEEN 415 or MEEN 416.

**MEEN-656. Boundary Layer Theory** **Credit 3 (3-0)**

This course covers the fundamental laws governing flow of viscous fluids over solid boundaries. Exact and approximate solutions are studied for various cases of boundary layer flow including laminar, transitional and turbulent flow. Prerequisite: MEEN 415 or 416.

**MEEN-657. Strengthening Mechanisms in Commercial Materials** **Credits 3 (3-0)**

This course bridges the gap between fundamental materials science courses and advanced mechanical properties courses. A primary objective of the course is to provide the student with an understanding of the principles and mechanisms involved in strengthening processes. The course provides a review of current microstructural and micro-chemical approaches used in developing high strength materials. Prerequisite: MEEN 560 or equivalent.

**MEEN-660. Selected Topics in Engineering** **Credits 3 (3-0)**

This course consists of selected mechanical engineering topics of interest to students and faculty. The topics will be selected before the beginning of the course and will be pertinent to the programs of the students enrolled. Prerequisite: Consent of instructor.

**MEEN-702. Continuum Mechanics** **Credits 3 (3-0)**

The applications of the laws of mechanics and thermodynamics to the continuum; a rigorous development of the general equations applied to a continuum; the application and reduction of the general equations for specific cases of both solids and fluids. Prerequisite: MEEN 336 or equivalent.

**MEEN-706. Theory of Vibrations** **Credits 3 (3-0)**

Vibration analysis of systems with one, two or multi-degrees of freedom. Instrumentation, continuous systems, computer techniques. Prerequisites: MEEN 440, MATH 332, and MEEN 581.



**MEEN-707. Real Time Analysis of Dynamic Systems** Credits 3 (3-0)

Theory and application of real time analysis used in system identification and machinery fault detection. RTA can be applied in production engineering and product development to study short-lived events or analyze system operation in time domain or frequency domain to identify system characteristics or possible problems. Prerequisite: Consent of instructor.

**MEEN-716. Finite Element Methods** Credits 3 (3-0)

This course covers fundamental concepts of the finite element method for linear stress and deformation analysis of mechanical components. Topics include the development of truss, beam, frame, plane stress, plane strain, axisymmetric isoparametric, solid, thermal, and fluid elements. ANSYS and NASTRAN software will be used for solving practical stress analysis problems. Prerequisite: Consent of instructor.

**MEEN-719. Advanced Computer-Aided Design** Credits 3 (3-0)

This course covers important methods and techniques for using the computer to aid the design process. Simulation and optimization methods are applied to the design of physical systems. Prerequisite: Consent of instructor.

**MEEN-731. Conduction Heat Transfer** Credits 3 (3-0)

Development of the general heat conduction equation. Applications to one, two, and three dimensional steady and unsteady boundary value problems in heat conduction. Closed form and numerical solution techniques. Prerequisite: MEEN 562 or equivalent.

**MEEN-732. Convection Heat Transfer** Credits 3 (3-0)

Analysis of heat convection in laminar and turbulent boundary layer and pipe flow; dimensional analysis; free convection; condensation and boiling. Prerequisite: MEEN 562 or equivalent.

**MEEN-733. Radiation Heat Transfer** Credits 3 (3-0)

A comprehensive treatment of basic theories; radiation characteristics of surfaces and radiation properties taking account of wave length, direction, etc.; analysis of radiation exchange between idealized and real surfaces; fundamentals of radiation transfer in absorbing, emitting, and scattering media; interaction of radiation with conduction and convection. Prerequisite: MEEN 562 or equivalent.

**MEEN-742. Tools, Jigs, and Fixtures** Credits 3 (3-0)

Tool design methods, tool-making practices, tool materials and heat treatments, plastics for tool materials. Design of cutting tools for N/C machine tools. Design of size and fixture; basics of clamping, chucking and indexing for various machining processes. Prerequisites: MEEN 560, MATH 332 or equivalent.

**MEEN-743. Instrumentation** Credits 3 (3-0)

Principles and practices of industrial measurement are presented in this course. Topics include instrument dynamics and response characteristics; theory of transducers for temperature, pressure, flow, motion, force; and other physical phenomena. Special topics in instrumentation, data acquisition and data reduction are covered. A project is assigned in an instrumentation application.

**MEEN-752. Mechanical Properties and Theories of Failure** Credits 3 (3-0)

Static properties in tension and compression; stress and combined stresses; fatigue, impact, creep, and temperature. Various theories of failure under the above loading conditions. Applications. Prerequisite: MEEN 336 or equivalent.



**MEEN-754. Deformation Analysis and Metal Processing** **Credits 3 (3-0)**

Analytic approaches to the solution of forming problems. Following a review of stress strain analysis, the relationship of stress to strain via various plasticity equations, yield conditions and deformation equations is examined. After the development of some methods of solution of forming problems, several model processes are examined; forging, extrusion, coining, rolling, and drawing. Prerequisites: MEEN 226 and MEEN 560 or equivalent.

**MEEN-756. Physical Metallurgy of Industrial Alloys** **Credits 3 (3-0)**

Review of principles of alloying and heat treatment and their application to commercially important alloy systems. Principles of corrosion. Prerequisites: MEEN 226 and MEEN 560 or equivalent.

**MEEN-785. Special Topics** **Variable (1-3)**

This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the Masters level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor.

**MEEN-792. Masters Seminar** **Credits 1 (1-0)**

Discussions and reports of subjects in mechanical engineering and allied fields will be presented. Prerequisite: Masters level standing.

**MEEN-793. Masters Supervised Teaching** **Credits 3 (3-0)**

Students will gain teaching experience under the mentor-ship of faculty who assist the student in planning for the teaching assignment, observe and provide feedback to the student during the teaching assignment, and evaluate the student upon completion of the assignment. Prerequisite: Masters level standing.

**MEEN-794. Masters Supervised Research** **Credits 3 (3-0)**

This course is supervised research under the mentorship of a faculty member. It is not intended to serve as the project nor thesis topic of the masters student. Prerequisite: Consent of instructor.

**MEEN-794. Masters Supervised Research** **Credits 3 (3-0)**

The course is supervised research under the mentorship of a faculty. It is not intended to serve as the thesis topic of the masters student. Prerequisite: Masters level standing.

**MEEN-796. Masters Project** **Credits 3 (3-0)**

The student will conduct advanced research of interest to the student and the instructor. A written proposal, which outlines the nature of the project must be submitted for approval. This course is only available to project option students. Prerequisite: Masters level standing.

**MEEN-797. Masters Thesis** **Credits 3 (3-0)**

Master of Science thesis research will be conducted under the supervision of the thesis committee chairperson leading to the completion of the Masters thesis. This course is only available to thesis option students. Prerequisite: Consent of advisor.

**MEEN-799. Masters Continuation** **Credits 3 (3-0)**

The course is for Masters students who have completed all required coursework and all Masters Project or Thesis credits. This optional course assists the student in maintaining full-time enrollment following completion of the Masters Project, MEEN-796 or Masters Thesis, MEEN-797. The course may be taken to allow time for the student to complete the final project or thesis write-up and to prepare for the masters project or thesis defense. Prerequisites: Completion of all required coursework and Masters Project or Thesis Credits.

**MEEN-804. Advanced Dynamics****Credits 3 (3-0)**

Lagrange's equations of motion as applied to rigid body dynamics. A study of generalized coordinates, generalized conservative and dissipative forces, degrees of freedom, holonomic constraints as related to rigid body motion. Also, a brief study of the calculus of variations and Hamilton's equations of motion. Prerequisite: MEEN 604 or equivalent.

**MEEN-808. Energy Methods in Applied Mechanics****Credits 3 (3-0)**

The use of energy methods in solving applied mechanics problems; applications include topics such as beams and frames, deformable bodies, plates and shells, buckling, variational methods. Prerequisite: MEEN 610 or equivalent.

**MEEN-810. Advanced Theory of Elasticity****Credits 3 (3-0)**

The analysis of strains, stresses, and the equations of elasticity, general formulation of the 2-D boundary value problems, and the formulation of certain three dimensional problems with symmetry. Prerequisite: MEEN 610 or equivalent.

**MEEN-813. Composite Structures****Credits 3 (3-0)**

This course focuses on the application of composite materials to the design and analysis of structures. The topics covered are two-and-three-dimensional hydrothermal anisotropic elastic constitutive equations; classical laminate theory; static stress, vibration, and buckling analysis of laminated beams and plates; environmental effects; and fatigue and fracture of laminated composites. Prerequisite: MEEN 613 or equivalent.

**MEEN-814. Mathematical Theory of Plasticity****Credits 3 (3-0)**

A review of elasticity including the stress and strain tensors, transformations and equilibrium and elastic behavior. Theories of strength, plastic stress/strain, classical problems of plasticity, including thick-walled pressure vessels and rotating cylinders in elastic-plastic conditions, slip line theory with applications. Prerequisite: MEEN 610 or equivalent.

**MEEN-820. Advanced Classical Thermodynamics****Credits 3 (3-0)**

Basic concepts and postulates; conditions of equilibrium; processes and thermodynamic systems; first and second order phase transitions; Nernst Postulate. Prerequisite: MEEN 442 or equivalent.

**MEEN 822. Statistical Thermodynamics****Credits 3 (3-0)**

Statistical mechanics and macroscopic properties from statistical methods. Equilibrium information, generalized coordinates, and general variables. Prerequisite: MEEN 442 or equivalent.

**MEEN-824. Irreversible Thermodynamics****Credits 3 (3-0)**

A study of processes which are inherently entropy producing. Development of general equations for the theory of minimum rate of entropy production, mechanical processes, life processes and astronomical processes. Prerequisite: MEEN 720 or equivalent.

**MEEN-834. Special Topics in Applied Heat Transfer****Credits 3 (3-0)**

Selected special topics in applied heat transfer such as heat exchanger design and performance, cooling of electronic equipment, advanced thermal insulation systems, etc. Prerequisite: MEEN 562 or equivalent.

**MEEN-838. Solar Thermal Energy Systems****Credits 3 (3-0)**

Characteristic of extraterrestrial and terrestrial solar radiation. Analysis of thermal performance of concentrating and non-concentrating solar collectors, thermal energy storage systems and energy transport systems. Life cycle cost analysis of solar energy systems. Computer simulations. Prerequisites: MEEN 731 and MEEN 732 or equivalent.

**MEEN-840. Machine Tool Design****Credits 3 (3-0)**

Outlines and general requirements of machine tools. Design principles: static and dynamic stiffness and rigidity. Criteria for requirements on stiffness, weight and cutting forces. Machine tool vibrations, stability against chatter, general features, theories. Damping and dampers. Transmission of motion and standardization of speed change gears. Design of constructional elements: bearings, electrical components, pneumatic, hydraulics, material selection, main spindle layouts. Prerequisites: MEEN 565 and MEEN 646 or equivalent.

**MEEN-846. Stochastic Modeling of Mechanical Systems****Credits 3 (3-0)**

This course involves an engineering approach to the analysis of time series and discrete linear transfer function models. Applications include the analysis of experimental data for system modeling, identification, forecasting, and control. Prerequisite: Consent of advisor.

**MEEN-847. Computational Engineering Dynamics****Credits 3 (3-0)**

Development of computer-oriented methods for the analysis and design of engineering dynamic systems; analytical and experimental techniques for model development and design refinement of components in flexible dynamics systems (machine tools, robots, moving vehicles, etc); optimization techniques for transient response analysis on both constrained and unconstrained systems. Prerequisite: Consent of instructor.

**MEEN-848. Digital Control of Machines and Processes****Credits 3 (3-0)**

This course covers control algorithms and design of discrete controllers. Interfaces and command generation for machines and process control are treated. Applications in numerically controlled machines and industrial robots are covered. Prerequisite: MEEN 648.

**MEEN-849. Computer Control of Robot Manipulators****Credits 3 (3-0)**

Introduction of basic robot control systems, sensory requirements and capabilities; microcomputer control of robotic systems, robot teaching systems; adaptive robot control systems; robot system diagnosis and applications. Prerequisite: MEEN 649 or Consent of instructor.

**MEEN-850. Phase Equilibria****Credits 3 (3-0)**

Interpretation and mathematical analysis of unary, binary and ternary, inorganic, phase equilibria systems with examples for solving practical materials science problems; isoplethal and isothermal sections, and crystallization paths; thermodynamic fundamentals. Prerequisite: Consent of instructor.

**MEEN-858. Mechanical Metallurgy****Credits 3 (3-0)**

A review of continuum mechanics followed by an examination of the microscopic basis of plastic behavior. Emphasis on the development and use of dislocation theory. Prerequisite: MEEN 714.

**MEEN-860. Fracture Mechanics****Credits 3 (3-0)**

This course introduces the student to the concept of stress and strain singularities and their effect on fracture strength and fatigues life of isotropic and anisotropic materials. Topics covered include computation of the stress-strain field around a crack-tip, stress-intensity-factor, strain energy release rate, J-integral, fracture toughness, residual strength, and fatigue crack propagation life. The course concepts are applied to the design of damage tolerant structures. Prerequisite: MEEN-560 or equivalent.

**MEEN-885. Special Topics****Variable (1-3)**

This course is designed to allow the introduction of potential new courses on a trial basis or special content courses on a once only basis at the doctorate level. The topic of the course and title are determined prior to registration. Prerequisite: Consent of instructor.

**MEEN-992. Doctoral Seminar****Credits 1 (1-0)**

In this course, doctoral students attend colloquia or seminars. They consist of presentations by doctoral students on dissertation topics and works-in-progress and by guests on important classical, contemporary, or research problems in mechanical engineering. Prerequisite: Doctoral level standing.

**MEEN-993. Doctoral Supervised Teaching****Credits 3 (3-0)**

This course is designed to introduce the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Doctoral students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Others planning to undertake a teaching career are also strongly encouraged to take it. Topics covered include: course planning, classroom teaching, lecture preparation, student evaluation, and grading. The supervisor(s) will observe and provide feedback to the student and evaluate the student's performance. Prerequisite: Doctoral level standing.

**MEEN-994. Doctoral Supervised Research****Credits 3 (3-0)**

This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisite: Consent of instructor.

**MEEN-995. Doctoral Preliminary Examination****Credits 3 (3-0)**

This is required of students who have completed the qualifier examination and who are taking the preliminary examination during the semester. This is a supervised program to help prepare the student for the preliminary examination under the mentorship of the academic advisor. Prerequisite: Doctoral level standing.

**MEEN-997. Doctoral Dissertation****Credits 3 (3-0)**

This supervised research serves as the dissertation of the doctoral student. Twelve credits of dissertation are required for graduation. Four sections each of three credits are offered each semester and summer. The student progresses from section 1 through 4 as part of a plan of study under the supervision of the academic advisor. Prerequisites: Doctoral standing & consent of advisor.

**MEEN-999. Continuation of Thesis for Mechanical Engineering Credits 1 (1-0)**

The course is for masters and doctoral students who have completed all required credit hour requirements. Prerequisite: Completion of all Thesis/Dissertation Credits.



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## Natural Resources and Environmental Design

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The Department of Natural Resources and Environmental Design offers a program leading to the Master of Science degree in Plant and Soil Science. Students may select any concentration in Applied Environmental Biology, Land Use and Management, Soil and Sustainable Fertility, Applied Environmental Chemistry, Soil Mineralogy, and Soil and Water Conservation. The objective of the program is to prepare students with the expertise needed to assume technical, teaching, research, and extension positions in universities, industries, and state/federal governments.

### DEGREE OFFERED

Plant and Soil Science - Master of Science

### GENERAL PROGRAM REQUIREMENTS

The admission of students to the graduate degree program in the Department of Natural Resources and Environmental Design is concurrent with the general admission requirements of the University. For other requirements refer to the graduate catalog.

### DEPARTMENTAL REQUIREMENTS

Candidate should have a Baccalaureate degree from an accredited undergraduate institution. A bachelor's degree in Agriculture is not required if the student has had adequate training in the basic sciences. The candidate should have a grade point average of 3.0 either in science and mathematics courses, or an overall undergraduate GPA of at least 2.8. The candidate must have a Graduate Record Examination (GRE) score of 950 for admission to the graduate program. Additionally, the candidates should have the following required courses and credits or their equivalent.

Chemistry	12-15 credit hours
Biology	12 credit hours
Mathematics and Calculus	12 credit hours
Physics	8 credit hours
Soil and Plant Sciences	6-7 credit hours

Students who have not completed the required or equivalent courses at the undergraduate level, but have satisfied all other requirements for admission, will be granted provisional or conditional admission and allowed to make up the deficiencies in the first two semesters.

### Thesis Option

This option consists of a minimum of 30 semester hours at the 600 and 700 levels, successfully pass a comprehensive examination and completion of a thesis. A student receives 6 semester hours credit for thesis.

## Non-thesis Option

This option consists of a minimum of 33 semester hours at 600 and 700 levels, successfully pass comprehensive examination and completion of a project report.

The student pursuing the Master of Science degree in Plant and Soil Science is required to complete a common core of courses consisting of 8 hours of the following courses: A student must take courses with asterisk (\*).

CHEM 441 or 651	Physical Chemistry or General Biochemistry	5 Semester Hours
*NARS 607	Research Design and Analysis	3 Semester Hours
*SLCS 717	Methodology in Soil, Plant, and Water Analysis	3 Semester Hours
*NARS 720	Graduate Seminar	1 Semester Hour

Students pursuing the M.S. in Plant and Soil Science are required to spend a minimum of two years to complete course work and a problem in applied research. In addition, a minimum of 16 semester hours is required by area of concentration.

## Courses offered in Plant and Soil Science - M.S. Program

Courses		Credits
AGEN 600	Soil and Water Engineering I	3 (2-2)
AGEN 624	Water Resources Engineering	3 (2-2)
AGEN 701	Soil and Water Design	3 (2-2)
AGEN 714	Applied Hydrogeology	3 (2-2)
EASC 622	Environmental Sanitation and Waste Management	3 (2-2)
EASC 624	Earth Science, Geomorphology	3 (2-2)
EASC 625	Earth Resources	3 (2-2)
EASC 644	Problem Solving in Earth Science	3 (2-2)
EASC 666	Earth System Science	3 (2-2)
EASC 699	Environmental Problems	3 (3-0)
EASC 705	The Physical Universe	3 (3-0)
EASC 706	Physical Geology	3 (3-0)
EASC 709	Seminar in Earth Science	2 (2-0)
EASC 718	Applied Environmental Microbiology	3 (2-2)
HORT 700	Plant Biotechniques	3 (1-4)
NARS 607	Research Design and Analysis	3 (3-0)
NARS 606	Special Problems in Crops	3 (3-0)
NARS 618	General Forestry and Ecology	3 (2-2)
NARS 777	Special Problems in Plant Sciences Graduate Studies	3 (3-0)
NARS 799	Graduate Thesis	6 (6-0)
NARS 777	Special Problems in Plant Sciences Graduate Studies	3 (3-0)
NARS 799	Graduate Thesis	6 (6-0)
NARS 999	Graduate Thesis (continued)	1 (1-0)
SLSC 609	Special Problems in Soils	3 (3-0)
SLSC 621	Soil Microbiology	4 (2-4)
SLSC 632	Soil Physics	3 (2-2)
SLSC 633	Soil Genesis, Classification and Land Use	4 (2-4)
SLSC 634	Soil Environmental Chemistry	4 (3-2)
SLSC 640	Wetland Management	3 (3-0)
SLSC 710	Soils of North Carolina	3 (2-2)

SLSC 715	Soil Mineralogy	3 (3-0)
SLSC 717	Methodology in Soil, Plant and Water Analysis	3 (0-6)
SLSC 727	Soil Fertility and Plant Nutrition	3 (3-0)
SLSC 734	Applied Environmental Chemistry	4 (4-0)

## COURSES WITH DESCRIPTION IN NATURAL RESOURCES AND ENVIRONMENTAL DESIGN

### Plant and Soil Science

#### Advanced Undergraduate and Graduate

#### **AGEN-600. Soil and Water Engineering I** **Credit 3 (2-2)**

This course will illustrate measures to improve soil and water use by evaluating and using present conservation practices and models. Water conveying and retaining structures, and soil conservation, drainage and irrigation systems will be discussed and designed. The course will emphasize sound environmental design practices. Prerequisite: AGEN 360 or Consent of instructor. (F)

#### **NARS-606. Special Problems in Crops** **Credit 3 (2-2)**

Designed for students who desire to study special problems in crops. Repeatable for a maximum of six credits. Prerequisite: Consent of the instructor required.

#### **NARS-607. Research Design and Analysis** **Credit 3 (2-2)**

Experimental designs, methods and techniques of experimentation; application of experimental design to plant and animal research; interpretation of experimental data.

#### **SLSC-609. Special Problems in Soil** **Credit 3 (3-0)**

Research problems in soils for advanced students. Prerequisite: Consent of the instructor.

#### **NARS-618. General Forestry and Ecology** **Credit 3 (2-2)**

History, classification, culture, and utilization of native trees, with special emphasis on their importance as a conservation resource and the making of national forestry policy, and the ecological impact of trees on environmental quality. Prerequisite: Botany-140.

#### **SLSC-621. Soil Microbiology** **Credit 4 (2-4)**

Discussion of major groups of organisms, their description, taxonomy, abundance, and their significance and functions. The major role of the microflora in elemental cycle and their presence in terms of agronomic and ecological importance. Prerequisites: SLSC-338 and Microbiology-121.

#### **AGEN-624. Water Resources Engineering** **Credit 3 (2-2)**

Analysis and design of water resources systems. Topics include: water resources planning, and development, hydraulic structures, introduction to aquifer analysis and contamination, well development, pump evaluation and selection, water quality and management, water laws, detention and retention ponds, wastewater management and remediation.

#### **SLSC-632. Soil Physics** **Credit 4 (2-4)**

This course is a study of fundamental physical principles and laws which govern the behavior of soils. Physical constitution soil water, and soil air and the relationship of soil physical conditions to plant growth and engineering usage will also be studied. Prerequisites: SLSC 338, CHEM 102, and MATH 113, and consent of instructor. Spring of even numbered years. (S)

**SLSC-633. Soil Genesis, Classification and Land Use****Credit 4 (2-4)**

Factors and processes of soil formation, grouping of soils based on their properties, soil mapping, soil interpretations for various uses and discussion of new concepts in soil taxonomy. Prerequisite: SLSC 338.

**SLSC-634. Soil Environmental Chemistry****Credit 4 (3-2)**

This course is a study of the chemical properties of soil environment including interactions of solid, liquid and gaseous phases. Discussion will also include ion and pollutant interactions with soil, their retention, potential movement and environmental impact. Additional discussion will include oxidation and reduction, soil acidity and alkalinity and their impact on waste management, resource utilization and the environment. (S)

**SLSC-640. Wetland Management****Credit 3 (3-0)**

Designed to provide a basic understanding of the benefits that wetlands in their natural conditions offer mankind, fish and wildlife habitat, water quality improvement, flood protection, filter traps for pollutants, erosion control, natural products, recreation, and aesthetics. Primary instructional areas will include wetland ecology, wetland systems of the southeast region, wetland law and regulations, soil conditions of wetlands, hydrology of wetlands, methodology of delineating wetlands, wetland irrigation, plant and vegetation identification, and writing environmental reports.

**GRADUATE STUDENTS ONLY****HORT-700. Plant Biotechniques****Credit 3 (1-4)**

Fundamentals of biotechniques in plant cell and tissue culture. These techniques are organogenesis, somatic embryogenesis isolation of plant cellular and plasmid DNA, RNA transformation and ELISA.

**AGEN-701. Soil and Water Engineering II****Credit 3 (3-0)**

The design of drainage and irrigation systems and their applicability to specific regions will be addressed. There will be in-depth discussion of saturated and un-saturated flow, and various equations that are used to solve soil water movement. Open channel flow, well hydraulics, and earth dams or embankments will be covered. Prerequisite: AGEN-600 or consent of the instructor.

**EASC-705. The Physical Universe****Credit 3 (3-0)**

The course is designed to give the student a broad general background knowledge of the earth's physical environment; its lithosphere, hydrosphere and atmosphere and their interaction on weather and climate. The physical nature of the star, the sun, and the planets will also be studied in the light of modern concepts of space.

**EASC-706. Physical Geology****Credit 3 (3-0)**

The development of the earth's surface, its material composition and forces acting upon its surface will be considered. Specific topics include origin of mountains and volcanoes, causes of earthquakes, work of rivers, wind, waves and glaciers. Prerequisite: Earth Science-705 or consent of the instructor.

**EASC-708. Conservation of Natural Resources****Credit 3 (3-0)**

A descriptive course dealing with conservation and development of renewable natural resources encompassing soil, water, and air; cropland, grassland, and forests; livestock, fish, and wildlife; and recreational, aesthetic and scenic values. Attention will be given to protection and development of the nation's renewable natural resources base as an essential part of the national security, defense, and welfare.



- EASC-709. Seminar in Earth Science** **Credit 3 (2-0)**  
 A seminar concerned with recent developments in the earth sciences and related disciplines.
- SLSC-710. Soils of North Carolina** **Credit 3 (2-2)**  
 A study of the factors basic to the understanding of the soils of North Carolina, their classification, and properties as related to sound land use and management. Prerequisite: Fundamentals of Soil Science 338.
- AGEN-714. Applied Hydrogeology** **Credit 3 (3-0)**  
 This course will cover basic principles of groundwater resource evaluation and the approach or techniques used to solve groundwater problems. Discussion will include methods used to quantitatively appraise hydrogeologic parameters affecting water-yielding capacity of wells and aquifers. Various types of aquifers will be discussed under the umbrella of confined and unconfined aquifers. Ground water quality, conservation and contamination will also be covered.
- SLSC-715. Soil Mineralogy** **Credit 3 (3-0)**  
 A study of soil minerals with regard to their composition, structure, classification, identification, origin, and significance. Special emphasis on primary weatherable silicates, layer silicates, and oxide minerals. Prerequisites: SLSC-534 and consent of the instructor.
- SLSC-717. Methodology in Soil, Plant and Water Analysis** **Credit 3 (0-6)**  
 A study of principles involved in the analysis of soils, plants and water. Emphasis on basic instrumental and chemical methods for interpretation of soil fertility and environment. Instruction in the use of special instruments. Prerequisite: Soil Chemistry-534.
- EASC-718. Applied Environmental Microbiology** **Credit 3 (2-2)**  
 Discussion of interactions between micro-organisms and their physical environment, and significance of micro-organisms in eutrophication, mining spoils, and waste treatments. Prerequisites: General Microbiology-121 and consent of the instructor.
- NARS-720. Graduate Seminar in Plant Science** **Credit 1 (1-0)**
- SLSC-727. Soil Fertility and Plant Nutrition** **Credit 3 (3-0)**  
 Fundamental and theoretical aspects of soil fertility, productivity and plant nutrients. A discussion of important research data on soil fertility and plant nutrition. Prerequisites: SLSC-517 and consent of the instructor.
- SLSC-734. Applied Environmental Chemistry** **Credit 4 (3-2)**  
 This course is an in-depth discussion of soil chemical interaction in term of ion exchange, solution equilibria, solubility patterns and also electrochemistry; comprehensive coverage of the chemistry of contaminant interactions with soil, its retention, movement and the environmental impact; review of relevant advances in soil chemistry in the past and recent times. Prerequisite: SLSC-534 or equivalent.
- NARS-777. Special Problems in Plant Science** **Credit 3 (3-0)**
- NARS-799. Graduate Thesis** **Credit 1-6 1 (1-0) to 6 (6-0)**
- NARS-999. Graduate Thesis (continued)** **Credit 1 (1-0)**

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## Physics

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The School of Graduate Studies through the Department of Physics offers two program tracks leading to the Master of Science in Physics: Professional Physics and Applied Physics. The Professional Physics track provides the comprehensive preparation needed for the pursuit of a Ph.D. in physics or related areas. The Applied Physics track provides opportunity for interdisciplinary studies and research with other science, engineering, and mathematics programs to broaden the experience for employment in business, industry, or government.

### DEGREES OFFERED

Professional Physics - Master of Science  
Applied Physics - Master of Science

### GENERAL PROGRAM REQUIREMENTS

Admission to the M.S. in Physics degree program in the Department of Physics is based upon the general admission requirements of the University. In addition, regular admission to the M.S. in Physics degree program requires the undergraduate degree in physics or its equivalent. Regular admission also requires that an applicant's background reflect maturity in physics from junior and senior level undergraduate courses in classical mechanics, electromagnetism, thermodynamics and statistical mechanics, and quantum physics. Applicants may be admitted to graduate studies unconditionally, provisionally, or as special students. Provisional admission may be granted to those whose training is in other disciplines related to physics.

### DEPARTMENT REQUIREMENTS

The M.S. in Physics degree program offers three options: the thesis option, the course work option and the project option. The thesis option requires a minimum of 30 semester hours, which includes 6 semester hours of thesis. The course work option requires a minimum of 33 semester hours plus a comprehensive examination. The project option requires a minimum of 30 semester hours plus 3 semester hours of special project. At least fifty percent of the courses counted towards the M.S. in Physics degree must be numbered 700 and above. In addition, the Professional Physics track requires a minimum of 24 semester hours of physics courses and the Applied Physics track requires a minimum of 18 semester hours of physics courses. The minimum physics course requirements include a core of competency courses in the following subjects: Classical Mechanics, Quantum Mechanics, Electromagnetic Theory, and Statistical Mechanics.

To meet graduation requirements, students must maintain and complete the M.S. in Physics program with an overall GPA of 3.0 or better on a scale of 4.0. Up to six semester hours of graduate work may be transferred from another university, provided it was not a part of any prior undergraduate degree requirement. The course content must adequately replace

current graduate offerings in the student's curriculum. Transfer credits should be at a level comparable to 600 or 700 level courses at North Carolina A&T.

## SUGGESTED CURRICULUM GUIDE

### First Year

First Semester		Credit	Second Semester		Credit
PHYS 600	Classical Mechanics	3	PHYS 630	Statistical Mechanics	3
PHYS 615	Electromagnetic Theory I	3	PHYS 715	Electromagnetic	
PHYS 620	Quantum Mechanics I	3		Theory II	3
			PHYS 720	Quantum Mechanics II	3

### Second Year

First Semester		Credit	Second Semester		Credit
PHYS 7XX	Elective		PHYS 7XX	Elective	
or			or		
7XX	Technical Elective	3	7XX	Technical Elective	3
PHYS 770	Research*		PHYS 770	Research*	
or			or		
PHYS 760	Special Topics*		PHYS 760	Special Topics*	
or			or		
PHYS 740	Seminar*	0-3	PHYS 740	Seminar*	0-3
or			or		
PHYS 791	Masters Project	0-6	PHYS 791	Masters Project	0-6
or			or		
PHYS 792	Masters Thesis		PHYS 792	Masters Thesis	0-6

\*Graduate courses in Research, Special Topics, or Seminar may be substituted from other technical areas upon appropriate approvals.

### List of Courses

Course	Description	Credit
PHYS 600*	Classical Mechanics	3 (3-0)
PHYS 605	Mathematical Methods	3 (3-0)
PHYS 615*	Electromagnetic Theory I	3 (3-0)
PHYS 620*	Quantum Mechanics I	3 (3-0)
PHYS 630*	Statistical Mechanics	3 (3-0)
PHYS 715*	Electromagnetic Theory II	3 (3-0)
PHYS 720*	Quantum Mechanics II	3 (3-0)
PHYS 730	Optical Properties of Matter	3 (3-0)
PHYS 735	Atomic & Molecular Physics	3 (3-0)
PHYS 736	Spectroscopic Techniques	3 (3-0)
PHYS 737	Physics of Solids	3 (3-0)
PHYS 738	Nuclear Physics	3 (3-0)
PHYS 739	High Energy Physics	3 (3-0)
PHYS 740	Graduate Seminar	Var. 1-3
PHYS 743	Experimental Methods in Physics	3 (2-3)
PHYS 745	Computational Physics	3 (2-3)

PHYS 750	Relativistic Quantum Mechanics I	3 (3-0)
PHYS 751	Relativistic Quantum Mechanics II	3 (3-0)
PHYS 760	Special Topics	Var. 1-3
PHYS 770	Research	Var. 1-9
PHYS 791	Masters Project	Var. 1-6
PHYS 792	Masters Thesis	Var. 1-6
*Required Core Courses		

### Courses for Professional Teachers

Course	Description	Credit
PHYS 705	Physics for Science Teachers I	Var. 1-6
PHYS 706	Physics for Science Teachers II	Var. 1-6
PHYS 707	Physics for Science Teachers III	Var. 1-6
PHYS 708	Physics for Science Teachers IV	Var. 1-6
PHYS 709	Physics for Science Teachers V	Var. 1-6

## COURSES WITH DESCRIPTION IN PHYSICS

### Advanced Undergraduate and Graduate

#### **PHYS-600. Classical Mechanics** **Credit 3 (3-0)**

A theoretical treatment of particle and rigid body dynamics. Topics include variational principles, Lagrangian and Hamiltonian mechanics, the physics of rotation, oscillations, canonical transformations and Hamilton's equations, and Hamilton-Jacobi theory. Prerequisite: Physics-401 or Graduate standing.

#### **PHYS-605. Mathematical Methods** **Credit 3 (3-0)**

Covers topics in mathematical physics: vector calculus, complex variables, Fourier theory, special functions and boundary value problems, variational methods, Green functions. Prerequisite: Graduate standing or consent of instructor.

#### **PHYS-615. Electromagnetic Theory I** **Credit 3 (3-0)**

Along with Physics 715, is an advanced study of electromagnetic phenomena: electromagnetic properties of matter; propagation, radiation, and absorption of electromagnetic waves; simple radiating systems; special relativity, covariant electrodynamics; radiation by moving charges. Prerequisite: Physics-416 or Graduate standing.

#### **PHYS-620. Quantum Mechanics I** **Credit 3 (3-0)**

An advanced study of quantum theory which along with Physics 720 covers the fundamental concepts and formulations: theory of measurement with applications to simple physical systems, operator formalism, symmetries and invariance, system of identical particles, angular momentum and the theory of spin, variational and perturbation approximation techniques, time-dependent perturbation theory and radiation, scattering theory with applications. Prerequisite: Physics-422 or Graduate standing.

#### **PHYS-630. Statistical Mechanics** **Credit 3 (3-0)**

Fundamentals of classical and quantum statistical mechanics: statistical ensembles and distribution functions, non-interacting particles, ideal Fermi and Bose systems, treatment of interacting systems, phase transitions, approaches to collective phenomena. Prerequisite: Physics-430 or Graduate standing.



## GRADUATE STUDENTS ONLY

### **PHYS-715. Electromagnetic Theory II**

**Credit 3 (3-0)**

A continuation of Physics-615. Prerequisite: Physics-615.

### **PHYS-720. Quantum Mechanics II**

**Credit 3 (3-0)**

A continuation of Physics-620. Prerequisite: Physics-620.

### **PHYS-730. Optical Properties of Matter**

**Credit 3 (3-0)**

Classical wave properties of light and quantum mechanical treatment of the interaction of light and matter: interference, diffraction, absorption, scattering, and polarization of light, interaction with atoms, atomic structure, optical absorption and emission, laser theory. Prerequisite: Graduate standing or consent of the instructor.

### **PHYS-735. Atomic and Molecular Physics**

**Credit 3 (3-0)**

An advanced study of atomic and molecular systems. Topics include many-electron atoms, Hartree-Fock and self-consistent field methods, interaction of many-electron atoms with electromagnetic fields; diatomic molecules, Born-Oppenheimer approximation, rotation and vibration and electron spectra of diatomic molecules, polyatomic systems, laser spectroscopy, and molecular dynamics. Prerequisite: Physics-465 or Graduate standing.

### **PHYS-736. Spectroscopic Techniques**

**Credit 3 (3-0)**

This course describes the methods and instrumentation of several spectroscopic techniques such as laser spectroscopy, optical resonance spectroscopy, supersonically cooled molecular spectroscopy, multiple photon spectroscopy, photoelectron spectroscopy, Raman scattering, Mössbauer spectroscopy, nuclear magnetic resonance spectroscopy, electron spin resonance spectroscopy, and mass spectroscopy. Prerequisites: Physics-465, 420 or Graduate standing

### **PHYS-737. Physics of Solids**

**Credit 3 (3-0)**

An advanced study of the physics of solids with applications to metals semiconductors, and insulators. Topics include electronic structures, dynamics of electrons in solids, transport properties, optical properties, magnetic properties, and superconductivity. Prerequisite: Graduate standing or consent of the instructor.

### **PHYS-738. Nuclear Physics**

**Credit 3 (3-0)**

Descriptions of properties of the nuclear force and nuclear structure: nucleon-nucleon scattering, nuclear scattering theory, phenomenological potential models, the shell model, collective motion, giant resonances, direct and compound reactions, few-body systems, heavy ion physics. Prerequisite: Graduate standing or consent of the instructor.

### **PHYS-739. High Energy Physics**

**Credit 3 (3-0)**

Theoretical and experimental concepts in high energy physics. Topics include elementary particles; conservation laws; strong, weak, and electromagnetic interactions; particle accelerators; beams and detectors; strange particles; and quark models. Prerequisite: Physics-738 or Graduate standing.

### **PHYS-740. Graduate Seminar**

**Variable Credit (1-3)**

A survey of current developments in physics.

### **PHYS-743. Experimental Methods**

**Credit 3 (2-3)**

Theory and techniques of measurement in experimental physics: experimental design, detector development, signal processing techniques, data acquisition, error analysis, statistics and the treatment of experimental data. Prerequisite: Graduate standing or consent of the instructor.

**PHYS-745. Computational Physics****Credit 3 (2-3)**

Computational approaches to advanced physical problems. Includes ordinary differential equations, boundary value and eigenvalue problems, matrix operations, Monte Carlo Methods, nonlinear equations, curve fitting, and approximation of functions. Prerequisite: Graduate standing or consent of instructor.

**PHYS-750. Relativistic Quantum Mechanics I****Credit 3 (3-0)**

Along with Physics-751 covers the Dirac equation and elementary mass renormalization, propagator theory, second quantization, the quantization of the electromagnetic field, Feynman graphs, calculations in quantum electrodynamics and quantum chromodynamics, gauge theories, models of electromagnetic, weak and strong interactions. Prerequisite: Physics-720 or Graduate standing.

**PHYS-751. Relativistic Quantum Mechanics II****Credit 3 (3-0)**

A continuation of Physics-750. Prerequisite: Physics-750.

**PHYS-760. Special Topics****Variable Credit (1-3)**

Studies in physics under staff guidance. Prerequisite: Graduate standing.

**PHYS-770. Research****Variable Credit (1-9)**

This course is a supervised research under the mentorship of a faculty mentor. It is not necessarily intended to serve as the project or thesis topic of a master's student.

**PHYS-790. Masters Project****Variable Credit (1-6)**

The student will conduct a research project under the supervision of an advisor. The project could be experimental, theoretical, or a literature survey on a topic of interest to the student. This course is available to project option students. Prerequisite: Consent of advisor and masters standing.

**PHYS-792. Masters Thesis****Variable Credit (1-6)**

The Master of Science thesis research will be conducted under the supervision of a thesis advisor to the completion of a masters thesis. The course is available to thesis option students. Consent of advisor and masters standing.

**Professional Teachers Program****PHYS-705. Physics for Science Teachers I****Variable Credit (1-6)**

For in-service teachers. Course covers fundamentals of astronomy and earth science. Full descriptive title, syllabus and the amount of credit will have received departmental approval before scheduling. Prerequisite: MATH-111 or equivalent.

**PHYS-706. Physics for Science Teachers II****Variable Credit (1-6)**

For in-service teachers. Lecture and integrated lab study of the fundamental principles of mechanics, thermodynamics, wave motion, electricity and magnetism, optics and modern physics. Full descriptive title, syllabus and the amount of credit will have received departmental approval before scheduling. Focus: Mechanics and Thermodynamics. Prerequisite: MATH-111 or equivalent.

**PHYS-707. Physics for Science Teachers III****Variable Credit (1-6)**

A continuation of PHYS-706. Focus: Wave motion and electricity and magnetism. Prerequisite: PHYS-706 or equivalent.

**PHYS-708. Physics for Science Teachers IV****Variable Credit (1-6)**

A continuation of PHYS-707. Focus: Optics and modern physics. Prerequisite: PHYS-707 or equivalent.

**PHYS-709. Physics for Science Teachers V****Variable Credit (1-6)**

A continuation of PHYS-708. Focus: Modern Physics. Prerequisite: PHYS-708 or equivalent.

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## Social Work

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Joint Master of Social Work Program\*  
Department of Sociology & Social Work

Dr. John Rife (UNCG), Program Director - 336-334-4098  
(<http://www.uncg.edu/swk>)

Dr. Sarah V. Kirk (NC A&T SU), Associate Program Director - 336-334-7894  
(<http://www.ncat.edu/~sociolog/>)

The Joint Master of Social Work (JMSW) program represents the efforts of faculty and administrators at North Carolina Agricultural and Technical State University (NC A&T SU) and the University of North Carolina at Greensboro (UNCG). The administration of the JMSW program rotates between the two campuses every four years.

This is a single academic program with instruction by faculty from each department. Students attend classes on the campuses of both universities and have access to all academic and support services of the two universities.

The program requires full-time participation of students. Successful completion of the degree requires 60 semester credit hours taken over two academic years. The program is fully accredited by the Council on Social Work Education.

The JMSW curriculum has been designed by the joint faculty from both institutions to provide students with *advanced generalist* social work education. The model for the curriculum is based on contemporary, state-of-the-art theory and practice methods. Courses reflect the theme of providing effective services to families in urban and rural North Carolina communities. The curriculum is organized by foundation, area of practice, advanced generalist integrative seminars, and field instruction. The primary purpose of the MSW program is to prepare students for advanced generalist social work practice.

\* Jointly administered with UNCG

Program goals are:

- Goal 1: To prepare graduate students for employment as advanced generalist social work practitioners in direct and indirect practice.
- Goal 2: To provide students with a graduate advanced generalist social work curriculum that results in the acquisition and demonstration of:
- A. Knowledge of human behavior and the social environment, social welfare policy, research, practice methods, cultural diversity populations at-risk, social and economic justice, and social work values and ethics as a foundation for generalist social work practice
  - B. The professional self as reflected in an affiliation with the profession of social work
  - C. The values and ethics of professional social work practice as stated by the National Association of Social Worker's Code of Ethics



D. Advanced generalist social work practice skills with individuals, families, groups, organizations, and communities.

Goal 3: To provide professional service that ameliorates social problems, provides leadership, and benefits our communities in Central and Western North Carolina.

Goal 4: To conduct and disseminate research that contributes to the knowledge base for effective social work practice.

## CURRICULUM PLAN

The curriculum design of the program provides students with a theoretical and applied education in social work to enhance and promote advanced generalist social work education. The two-year program is organized to insure that all students, as advanced social work practitioners, will be prepared to independently engage in social work practice with individuals, families, small groups, organizations, and communities in their chosen area of practice. Students will be prepared to serve as managers, supervisors, researchers and social planners. The concentration of the program is advanced generalist practice.

## COURSE OF STUDY AND DEGREE REQUIREMENTS

The MSW program is a two-year program of 60 credits that will require full time enrollment by students. The program offers a foundation year and a second year of concentration content for advanced practice.

### First Year Foundation Courses (30 Hours)

NCA&TSU		UNC-G
First Semester	15 Credit Hours	
SOWK 700	Human Behavior and Social Functioning I	SOWK 501
	3	
SOWK 701	Social Welfare Policy and Analysis I	SOWK 502
	3	
SOWK 703	Social Work Practice with Individuals and Families	SOWK 504
	3	
SOWK 704	Interpersonal Skills Lab (Social Work With Groups)	SOWK 560
	3	
SOWK 705	Social Work Practice and Human Diversity	SOWK 511
	3	
	<hr/> 15	

**Second Semester**

**15 Credit Hours**

SOWK 702	Human Behavior and Social Functioning II	3	SOWK 517
SOWK 707	Social Work Research Methods I	3	SOWK 503
SOWK 708	Social Work Practice with Communities and Organizations I	3	SOWK 514
SOWK 709	Field Instruction and Seminar I	6	SOWK 516
		<hr/>	
		15	

**Second Year- Advanced Curriculum (30 Hours)**

<b>First Semester Area of Practice Course</b>		<b>Credit</b>	
SOWK 706	Social Policy and Welfare Analysis II	3	SOWK 512
SOWK 710	Social Work with Families and Youth at Risk	3	SOWK 601
SOWK 712	Social Work in Health Care I		SOWK 602
SOWK 714	Social Work in Mental Health I		SOWK 603
SOWK 718	Research Designs & Data Analysis for Social Work Practice	3	SOWK 513
SOWK 722	Field Instruction and Seminar II	6	
		<hr/>	
		15	

<b>Second Semester Area of Practice Course</b>		<b>Credit</b>	
SOWK 711	Social Work with Families and Youth at Risk II	3	SOWK 611
SOWK 713	Social Work in Health Care II		SOWK 612
SOWK 715	Social Work in Mental Health II		SOWK 613
SOWK 716	Social Work in Administration	3	SOWK 605
Elective		3	
SOWK 724	Field Instruction and Seminar II	6	SOWK 616
		<hr/>	
		15	
<b>Total Hours</b>		<b>60</b>	

**FOUNDATION YEAR**

During the first year, students complete 30 semester hours of foundation course work. In the first semester of the first year, students complete courses in human behavior and social functioning, social welfare policy, social work practice and human diversity, social work practice with individuals and families, and social work practice with groups. In the second semester of the first year, students complete a second human behavior and social functioning course, social work practice with communities and organizations, social work research methods, and a six semester hour foundation field instruction placement and seminar. The purpose of the foundation course work during the first year is to prepare students for the advanced generalist practice year.

## ADVANCED GENERALIST PRACTICE YEAR

In the second year of study, students complete the concentration in advanced generalist practice. The second year of study requires the completion of 30 semester hours of course work. Students choose one of three advanced generalist practice areas: families and youth at-risk, mental health, or health. Students complete two courses in their advanced generalist practice area, advanced courses in social welfare, administration, and research, and they complete two semesters of advanced generalist field instruction, which includes a field seminar and a capstone project. Students also complete one graduate level elective. Choice of this elective requires the approval of the student's educational advisor.

## ADMISSIONS

A Joint Admissions Committee has been established for this program. It is comprised of faculty members from NCA&TSU and faculty members from UNCG. These committee members use a common evaluation system to review applications and recommend applicants for admission.

In addition to the admission materials set forth by The Graduate School, applicants must complete the following prerequisites to become eligible for admissions review:

1. Completion of a baccalaureate degree, with competitive grades, from an accredited college or university in the United States or its equivalent in another country;
2. A "B" average or better in the undergraduate major;
3. An overall minimum GPA of 2.5 and an acceptable score on the GRE;
4. Evidence of a liberal arts foundation to include the following minimum 30 credit hours:

18	Social and Behavioral Sciences*
6	Humanities
3	Human Biology
3	Statistics

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### 30 Hours

\* (Political Science, Psychology, Anthropology, Economics, Ethnic/Global Studies, History, and Sociology).

5. Applicants must demonstrate intellectual and personal qualifications considered essential to the successful practice of social work, such as sensitivity and responsiveness in relationships, concern for the need of others, adaptability, good judgment, creativity, integrity, and skill in oral and written communication. This determination shall be based on a review of the applicant's references and written personal statement.

Documentation validating that applicants meet the above criteria will be required in the admission packet. Members of the Joint Admissions Committee and staff at the two graduate schools will verify that acceptable validation of these five criteria have been included in applicants admission materials.

The Joint Admissions Committee has established five areas that will be rated to determine admission decisions:

1. Acceptable GRE scores;
2. GPA averaged from all undergraduate and graduate degrees;
3. Three letters of recommendation;
4. Relevant paid and/or volunteer experience (including internships in social work); and,
5. A personal statement indicating why applicant is seeking admission, what applicant wants to learn and the factors that influenced this decision.

Consistent rating measures have been established for the evaluation of the five above areas. The Joint Admissions Committee has developed a review process that ensures a consistent and fair evaluation of applicants. All applicants will be notified in writing of the Joint Admissions Committee decisions by The Graduate School.

The M.S.W. Program does not grant academic credit for life or work experience. Only students who have been admitted to the program and who have completed all required prerequisite course work may be admitted to practice courses and to the field instruction program.

The program admits students only once a year for Fall semester enrollment. Questions concerning the MSW program may be addressed to the Department of Sociology & Social Work, NCA&TSU. The phone number is (336) 334-7894. All inquiries concerning admission for Fall 2002 should be directed to: The Graduate School, University of North Carolina at Greensboro, PO Box 26176, Greensboro, NC 27402-6176. The phone number is (336) 334-5596.

Applications for admission of Fall 2003 – 2006 will be processed through the School of Graduate Studies, North Carolina A&T State University, 1601 East Market Street, 120 Gibbs Hall, Greensboro, NC 27411. The phone number is (336) 334-7920.

## **COURSE DESCRIPTIONS IN SOCIAL WORK**

### **SOWK-700. Human Behavior and Social Functioning I** **Credit 3 (3-0)**

This course is the first of a two course sequence on human behavior in the social environment. This course emphasizes theories of human behavior and intervention with people in a variety of systems, including individuals, families, and small groups. Students will learn an ecological framework for understanding and assessing human behavior in social and cultural contexts. Content about various oppressed and vulnerable groups is included. Culture is examined to analyze how it affects clients and workers perceptions of problems, their conceptualizations of strategies for problem-solving, their orientations in measuring treatment outcomes, and the efficacy of the worker-client relationship.

### **SOWK-701. Social Welfare Policy and Analysis I** **Credit 3 (3-0)**

This first foundation policy course is designed to help the student examine philosophical, social, political, psychological, and economic factors that have influenced the emergence of social welfare as a social institution. Students learn to analyze social policy for its effects on individuals, families, various oppressed and vulnerable groups, and communities. The impact of social policy on service delivery in rural areas will be highlighted. This is the first of two policy courses.

### **SOWK-704. Interpersonal Skills Lab (Social Work with Groups)** **Credit 3 (3-0)**

The purpose of the Interpersonal Skills Lab is to prepare students for entry into field instruction. The course allows students the opportunity to examine and practice interpersonal communication skills in preparation for professional practice. This course introduces students to a number of skills considered basic to social service delivery. Experiential learning is stressed, and ample opportunity will be provided for students to practice basic interpersonal skills and receive feedback on their performance. This course is taken concurrently with Social Work Practice with Individuals and Families.

### **SOWK-705. Social Work Practice and Human Diversity I** **Credit 3 (3-0)**

This course will examine cultural and social diversity and address theoretical and practice dimensions of social practice with oppressed people of color, women, the aged, the sexually diverse, and the physically disabled. The concepts of ethnicity, minority status, social



stratification, and sexual preference are explored in the context of American culture and are translated into the impact of dealing with these issues with clients, the system, and with the helper.

### **SOWK-706. Social Welfare Policy and Analysis II**

**Credit 3 (3-0)**

This course, the second foundation course in social welfare policy, presents social welfare policy analysis as another form of social work practice, with a repertoire of roles, functions, and skills as in other practice concentrations such as interpersonal or planning and management. As a part of this school's professional curriculum, the course will embody the primary value of social justice as it examines policies, programs and current delivery systems in addressing issues affecting families, mental and health care. Strategies to shape and frame policy at various levels are addressed.

### **SOWK-707. Social Work Research Methods I**

**Credit 3 (3-0)**

This course is the first of two research courses in the MSW curriculum. The intention of both courses is to prepare the social work practitioner to use research as a means of informing and improving one's professional practice. The primary purpose of this course is to provide a framework for the rigorous study of research methodology as it relates to the professional practice of social work. As a result of this course, students will learn, appreciate, and be able to apply quantitative and qualitative research strategies to address fundamental social work problems and processes.

### **SOWK-708. Social Work Practice with Communities, and Organizations**

**Credit 3 (3-0)**

This course is designed to prepare students to practice in the area of macro social work. Advanced generalist social workers must be prepared to respond to and influence changing social and political environments. This course prepares students for involvement in broad scale social systems change particularly in group, community, and organizational development and analysis. This course provides a framework for exploring knowledge, analytical skills, and professional behavior appropriate for practice with work groups, communities, and organizations. Particular emphasis will be given to the multidimensional strategies for professional intervention.

### **SOWK-709. Field Instruction and Seminar I**

**Credit 6 (6-0)**

This is the first year of the field curriculum. The purpose of the two courses is to provide an opportunity to students to synthesize theoretical knowledge for application within a variety of agency settings and among diverse client systems. Students are expected to apply theories and concepts from previous courses in the role of a professional social work practitioner within the client system of various field agency experiences. Field seminar will run concurrently with the field practicum. Student field days are typically Wednesday, Thursday and Friday for a total of 24 clock hours per week.

### **SOWK-710. Social Work with Families I**

**Credit 3 (3-0)**

This is the first course in the concentration on Social Work with Families and Youth at Risk. This course will integrate elements of social policy that affect families with the theory, knowledge, and skills necessary to work with diverse family forms at different stages of life. Building on foundation year content regarding the families, this course will prepare students to assess and intervene with families at an advanced level. An ecological systems perspective will be utilized to help students understand the relationships between individuals and their families and between families and the various social systems with which they interact.

**SOWK-711. Social Work with Families II****Credit 3 (3-0)**

This is the second course in the concentration sequence on Social Work with Families and Youth at Risk. This course will build on the advanced knowledge and skill gained in the previous course and allows students to apply that knowledge to specific problems faced by families across the life span. By participating in this problem-focused course, students will have an opportunity to learn more about the types of problems families face in the United States and how to use various interventive models most appropriate to specific types of problems.

**SOWK-712. Social Work in Health Care I****Credit 3 (3-0)**

This is the first of two courses in social work practice within the health care delivery system. Students utilize a functional health and systems model to analyze biomedical and psychosocial aspects of coping with health and illness. Students explore the complex interrelationships between health care practices, social work values, and ethical dilemmas presented by conflicting ideologies and advancing technology. Students will integrate knowledge and skills to deliver social work intervention in various health settings including hospitals, hospice, geriatrics, home health care, public health, and community health education.

**SOWK-713. Social Work in Health Care II****Credit 3 (3-0)**

This course further explores various practice models for working within different health and aging settings. Students explore direct and indirect skills needed to function in a variety of settings including hospitals, hospices, geriatrics, home health and health education initiatives. Special attention is given to assessing and understanding differential patterns of health care service utilization and delivery based on demographic characteristics such as age, race, ethnicity, gender, sexual orientation, and residence. Students will gain knowledge and skills in health and geriatric social work practice to work with individuals, families, and small groups.

**SOWK-714. Social Work in Mental Health I****Credit 3 (3-0)**

This course, the first of two concentration courses in social work practice in mental health, is designed to expose students to major policy issues, practice theory, and direct service roles in both inpatient and outpatient mental health settings. Students will gain knowledge of the history of mental practice in the United States, major advances in psychiatric care from biological, social, and interpersonal perspectives, and current practice approaches with vulnerable populations.

**SOWK-715. Social Work in Mental Health II****Credit 3 (3-0)**

This course, the second of two concentration courses in social work practice in mental health, is designed to expose students to specific clinical approaches to the practice of social work in mental health settings. Using a seminar format and a case study approach, students will expand their knowledge and skills from the first concentration course in treating specific mental disorders. Students examine the context of mental health practice including the impact of policy and organizations upon practice as well as the strengths and constraints of multidisciplinary treatment approaches.

**SOWK-716. Social Work in Administration****Credit 3 (3-0)**

As advanced generalist practitioners, students must be prepared for indirect as well as direct practice roles. The purpose of this course is to provide students with the basic knowledge and skills necessary to function as a social work supervisor and manager. Students from the three concentrations will take this course together, thus allowing all students to gain a broader understanding of social work administrative issues in various fields of practice. This course will highlight specific issues relevant to social work management in both urban and under-served rural areas.

**SOWK-718. Research Designs and Data Analysis for  
Social Work Practice**

**Credit 3 (3-0)**

This course is the second of two research courses in the MSW curriculum. The intention of both courses is to prepare the social work practitioner to use research as a means of informing and improving one's professional practice. Students will be able to apply quantitative and qualitative research strategies to address fundamental social work problems and processes

**Elective**

**Credit 3 (3-0)**

**SOWK-722. and SOWK-724. Field Instruction and  
Seminar II and III**

**Credit 6 (6-0) each**

Second year field is a culmination of the academic preparation for Social Work practice. As advanced Generalists, students are expected to demonstrate understanding and application of social work theories, skills and interventions. Additionally, students are expected to assume greater independence in their own practice. Field Seminar will run concurrently with the field practicum. Student field days will typically be Wednesdays, Thursdays and Fridays of each week, August- May. Specialized placements in School Social Work require a longer placement. School social work internships include activity three days a week for the academic year, August-June.

**Department of Sociology and Social Work**

Dr. Sarah V. Kirk, Chairperson  
201 Gibbs Hall

Note: The courses listed below are offered to advanced undergraduate and graduate students only. Please note that these courses are not part of the Joint Master of Social Work (JMSW) curriculum.

**Courses Offered for Advanced Undergraduate and Graduate Students**

SOCI-600	Seminar in Social Planning
SOCI-601	Seminar in Urban Studies
SOCI-603	Introduction to Folklore
SOCI-625	Sociology/Social Service Internship
SOCI-650	Independent Study in Anthropology
SOCI-651	Anthropological Experience
SOCI-669	Small Groups
SOCI-670	Law and Society
SOCI-671	Research Methods II
SOCI-672	Selected Issues in Sociology
SOCI-673	Population Studies
SOCI-674	Evaluation of Social Programs
SOCI-701	Seminar in Cultural Factors in Communication

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## Transportation and Logistics

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Michael Simmons, Chairperson  
Room 325, Merrick Hall  
(336) 334-7744  
simmons@ncat.edu

The Department of Economics and Transportation/Logistics offers programs of study leading to the Master of Science in Management degree with a concentration in Transportation and Logistics. The program prepares students and professionals for careers in public and private sector positions in transportation and business logistics. The program blends traditional management education in the areas of marketing, management, and quantitative analysis, with specialized core competencies relating to transportation planning, transportation and business logistics, supply chain and materials management, and purchasing.

### DEGREE OFFERED

Master of Science in Management – Transportation and Logistics

### GENERAL PROGRAM REQUIREMENTS

The general requirements for admission are an undergraduate degree from an accredited institution with a grade point average of 2.50 (on a 4.0 scale), and satisfactory GMAT scores. Applicants who do not meet the requirements will be considered on an individual basis. A GPA of 3.0 is required for graduation.

### PROGRAM REQUIREMENTS

Students with a variety of undergraduate majors are encouraged to apply. The program is designed to appeal to those who either currently work in industry or desire to affiliate with firms or organizations using cutting-edge tools to deliver their products or services. Students in the program will have a business related undergraduate degree and wish to study a particular area in greater depth, or have personal or professional interests or experiences that would be enhanced by a high quality graduate program in management education.

The program requires a minimum of 30 semester-hours. There is no thesis requirement. Students without an undergraduate business-related degree will be required to take appropriate foundation courses, which may extend the requirements to 42-45 semester-hours. The program consists of 18 hours of core courses, including one 3-hour elective, and 15 hours of coursework in the major concentration.

The student pursuing the Master of Science in Management is required to complete a common core of courses consisting of:

ACCT 714	Managerial Accounting & Finance	3 semester hours
BUAD 715	Quantitative Business Analysis	3 semester hours
BUAD 716	Strategic Marketing	3 semester hours
BUAD 718	Management & Organization Analysis	3 semester hours
ECON 608	Managerial Economics	3 semester hours



**ELECTIVE**

COMP 710	Software Specialization, Analysis & Design	3 semester hours
INEN 618	Total Quality Management	3 semester hours
INEN 658	Project Management	3 semester hours

**One course selected from the following:**

Courses in the Transportation and Logistics concentration will consist of the following courses:

TRAN 701	Strategic Logistics Management	3 semester hours
TRAN 720	Analysis and Design of Supply Chain Systems	3 semester hours
TRAN 725	Purchasing and Materials Management*	3 semester hours
BUAD 740	Management & Implementation of MIS*	3 semester hours
TRAN 727	Global Supply Chain Management	3 semester hours
TRAN 730	Transportation Planning	3 semester hours

*\*Based on prior academic studies, student will enroll in either TRAN 725 or BUAD 740*

Students without an undergraduate business-related degree will be required to take appropriate foundation courses, which consist of the following.

ACCT 708	Seminar in Financial Concepts	3 semester hours
BUAD 705	Seminar in Business Analysis	3 semester hours
BUAD 712	Foundation of Enterprise Management	3 semester hours
ECON 706	Seminar in Economics	3 semester hours

**LIST OF GRADUATE COURSES**

Course	Description	Credit
ACCT 708	Seminar in Financial Concepts	3
ACCT 714	Managerial Accounting & Finance	3
BUAD 705	Seminar in Business Analysis	3
BUAD 712	Foundation of Enterprise Management	3
BUAD 715	Quantitative Business Analysis	3
BUAD 716	Strategic Marketing	3
BUAD 718	Management & Organization Analysis	3
BUAD 740	Management & Implementation of MIS	3
ECON 706	Seminar in Economics	3
ECON 608	Managerial Economics	3
TRAN 701	Strategic Logistics Management	3
TRAN 720	Analysis and Design of Supply Chain Systems	3
TRAN 725	Purchasing and Materials Management	3
TRAN 727	Global Supply Chain Management	3
TRAN 730	Transportation Planning	3

## **COURSES WITH DESCRIPTION IN ECONOMICS AND TRANSPORTATION AND LOGISTICS**

### **ECON-608. Managerial Economics**

**Credit 3 (3-0)**

This course will apply economic principles to decision-making in management. The basic tools and methods of analysis are derived mainly from microeconomics. Additional tools discussed include statistical methods, operations research, financial analysis, and decision-making theory that are applied to managerial decision-making problems. Particular emphasis will be placed on demand analysis, forecasting, pricing and output decisions, present value analysis, cost-benefit analysis, capital budgeting, risk analysis, and decision making under uncertainty.

### **ECON-706. Seminar in Economics**

**Credit 3 (3-0)**

This course introduces basic microeconomic principles and their applications in business. Basic economic concepts, including marginal analysis of consumer and firm decisions, will be covered along with macroeconomic theories that support managers understanding of the global economic environment and the economic policies affecting that environment.

### **TRAN-701. Strategic Logistics Management**

**Credit 3 (3-0)**

This course is designed to introduce students to the critical role of logistics in the achievement of strategic objectives. This approach involves all activities associated with moving raw materials, inventory, and finished goods from the point of origin to the point of use or consumption. The course addresses logistics strategy, planning, customer service goals, transportation fundamentals and decision-making, transportation strategy, inventory and location strategies, organization and control.

### **TRAN-720. Analysis and Design of Transportation and Logistics Systems**

**Credit 3 (3-0)**

This logistics modeling course deals with modeling logistics forecasts to facilitate supply chain management, mode selection, distribution planning, facility location, network design and optimization, and routing and scheduling. Software will be used extensively to model logistics and supply chain applications.

### **TRAN-725. Purchasing and Materials Management**

**Credit 3 (3-0)**

This course focuses on purchasing as the integration of long-term materials planning with corporate strategic planning. It focuses on the increasingly strategic role of the purchasing professional in business organizations. Areas receiving special attention include collaborative participation in the identification and procurement of key material requirements, determination and application of supplier qualification and selection activities, implementation of supplier development programs, relationship building programs, and participation in supply chain development decisions.

### **TRAN-727. Global Supply Chain Management**

**Credit 3 (3-0)**

This course addresses issues in global supply chain management. Some topics addressed are international sourcing, evaluating international suppliers, outsourcing, financial management issues, relationship management, information management, and selecting international carriers. The course relies on cases to understand and solve problems in global supply chain management.

**TRAN-730. Transportation Planning****Credit 3 (3-0)**

This course addresses the transportation planning process and related activities. Topics of special focus are modal classifications, data requirements, transportation demand analysis, and methods of evaluation (GIS, cost-benefit analysis, internal rate of return, payback period, etc). Others are multiple criteria evaluation method, post-project evaluation, finance, transportation demand management, and issues in intelligent transportation systems.

# **NORTH CAROLINA A&T STATE UNIVERSITY GRADUATE FACULTY MEMBERSHIP**

## **Policy # 2000**

- Eligibility:** All tenure-track faculty ranked at Assistant Professor or above in teaching/research positions are expected to be either Associate or Full Members of the Graduate Faculty.
- Associate Status:** The necessary qualification for consideration as an Associate Member of the Graduate faculty is appointment at the rank of Assistant Professor or higher, including adjunct and visiting categories. Graduate faculty status is awarded upon the recommendation by the department head and approval of the Dean of Graduate Studies. The candidate should hold a doctoral degree. Should the candidate not hold a doctoral degree, there should be demonstrable evidence that the candidate possesses the experience, knowledge, and capability in the area of the intended participation in the graduate program appointed to.
- Full Status:** Full members of the Graduate faculty will be tenured (or tenure-track) faculty who have distinguished themselves in research, thesis direction and graduate teaching. Evidence of such distinction is indicated by a number of significant publications, service as chair of advisory committees for several master's students or as co-chair of the advisory committee for doctoral students, and by excellence in graduate teaching. In certain instances, one or two of these experiences may be considered sufficient. A member of the Graduate faculty holding full status may participate fully in all phases of the graduate enterprise of North Carolina A&T State University.
- Application:** Graduate Faculty Nomination Forms may be obtained from the School of Graduate Studies. Recommendations by the department head for Associate Graduate Faculty status do not have to be approved by that department's full faculty. However, they may recommend to the Graduate School members of their faculty for full Graduate faculty membership only after consultation with the department's full Graduate faculty members. The full Graduate faculty members should meet as a body with their department head to vote whether to recommend a faculty member for full membership. A simple majority is required to forward a recommendation, and the vote should be noted on the application form. All Graduate faculty in the department should be made aware of the Graduate School's final decision.



**Responsibilities: Associate status**

- Teach graduate level courses
- Serve as a member of graduate advisory committees
- Chair master's advisory committees
- Co-chair doctoral advisory committees, when committee chair holds full Graduate faculty status
- Serve as Graduate School Representatives when called upon by Graduate School.

**Full status**

- Teach graduate level courses
- Serve as a member of graduate advisory committees
- Chair master's and doctoral advisory committees (where appropriate)

**Removal of**

**Graduate Faculty:** Removal from the Graduate faculty should be initiated by the full members of the Graduate faculty of the department or program. If after a review by the department and upon consultation with the college/school dean it is decided that a person no longer should be a member of the Graduate faculty, then the department should make this recommendation to the Dean of the Graduate School and the Vice Chancellor for Academic Affairs. The memo from the Department Head should give the vote of the full members of the Graduate Faculty. Upon receipt of the recommendation, the Dean of Graduate Studies is authorized to remove the person from the Graduate Faculty.

## GRADUATE FACULTY

### School of Agriculture and Environmental Sciences

**Department:** Agribusiness, Applied Economics, and Agriscience Education  
**Chair:** Dr. Anthony K. Yeboah

- Antoine J. Alston, B.S., M.S., North Carolina A&T State University; Ph.D., Iowa State University; Assistant Professor
- William Amponsah, B.S., Berea College; M.S., University of Kentucky; Ph.D., Ohio State University; Adjunct Associate Professor
- Kofi Adu-Nyako, B.S., University of Science and Technology; M.S., Cornell University; Ph.D., University of Florida; Adjunct Associate Professor
- Frank Clearfield, B.S., East Stroudsburg State University; M.S., University of South Florida; Ph.D., University of Kentucky; Adjunct Assistant Professor
- Godfrey Ejimakor, B.S., North Carolina State University; M.S., North Carolina A&T State University; Ph.D., Texas Tech. University; Adjunct Associate Professor
- Benjamin Gray, B.S., M.S., North Carolina A&T State University, Ph.D., North Carolina State University; Adjunct Assistant Professor
- Daniel M. Lyons, B.S., M.S., North Carolina A&T State University; Ed.D., Virginia Polytechnic Institute and State University; Agricultural Extension Faculty
- Dalton H. McAfee, B.S., Alcorn State University; M.S., Tuskegee University; Ph.D., Ohio State University; Agricultural Extension Faculty
- Donald R. McDowell, B.S., Southern University A&M; M.S., Ph.D., University of Illinois; Professor
- John O'Sullivan, B.A., Stanford University; M.S., Auburn University; Ph.D., University of California at Los Angeles; Agricultural Extension Faculty
- Xiang Dong Qin, B.S., Fudan University; M.S., University of Brussels; Ph.D., Clemson University; Adjunct Assistant Professor
- Richard D. Robbins, B.S., North Carolina A&T State University; M.S., Ph.D., North Carolina State University; Professor
- Terrance Thomas, B.S., University of West Indies; M.S., University of Wisconsin; Ph.D., Louisiana State University; Associate Professor
- Alton Thompson, B.S., North Carolina Central University; M.S., Ph.D., Ohio State University; Professor
- Anthony K. Yeboah, B.S., University of Science and Technology; M.S., Ph.D., Iowa State University; Professor

**Department:** Animal Sciences  
**Chair:** Dr. Charles T. Kadzere

- John W. Allen, B.S., University of Georgia; M.S., Ph.D., University of North Carolina; Adjunct Assistant Professor
- Doris G. Fultz, B.S. (Biology), Virginia Commonwealth University; B.S. (Animal Science), DVM, Tuskegee University; Associate Professor
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Willie Willis, B.S., Fort Valley State University; M.S., Ph.D., Colorado State University; Professor

Mulumebet Worku, B.Sc., Addis Ababa University, Alemaya College of Agriculture, Ethiopia; M.S., Ph.D., University of Maryland, College Park; Adjunct Assistant Professor

**Department:**      **Natural Resources**  
**Chair:**              **Dr. Richard Robbins (Interim)**

G.A. Gayle, B.S., North Carolina A&T State University; M.S., Ph.D., N.C. State University; Professor

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C.W. Raczkowski, B.S., M.S., Kansas State University; Ph.D., N.C. State University; Adjunct Asst. Professor

G.B. Reddy, B.S., M.S., A.P.A.U. (India); Ph.D., University of Georgia; Professor, Graduate Program Coordinator

M.R. Reddy, B.S., Osmania University; M.S., A.P.A.U. (India); Ph.D., University of Georgia; Professor

Manuel R. Reyes, B.S., University of the Philippines at Los Banos; M. Phil., Cranfield Institute of Technology, England; Ph.D., Louisiana State University; Assistant Professor

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G.A. Uzochukwu, B.S., M.S., Oklahoma State University; Ph.D., University of Nebraska; Professor

**Department:**      **Human Environment and Family Sciences**  
**Chair:**              **Dr. Rosa Purcell**

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Ramona T. Clark, B.A.S.W., M.S.W., California State University; Ph.D., Oklahoma State University; Associate Professor

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Chung W. Seo, B.S., M.S., Korea University; Ph.D., Florida State University; Professor

Carolyn Turner, B.S., M.S., University of North Carolina at Greensboro; Ph.D., Virginia Polytechnic Institute; Associate Professor

Wilda Wada, R.D., B.S., M.S., North Carolina A&T State University; Ph.D., University of North Carolina at Greensboro; Food and Nutrition Specialist

## College of Arts and Sciences

**Department:** Biology

**Chair:** Dr. David W. Aldridge (*Interim*)

David W. Aldridge, B.S., University of Texas, Arlington; Ph.D., Syracuse University; Professor and Interim Chair

Jerry Bennett, B.S., Tougaloo College; M.S., Atlanta University; Ph.D., Iowa State University; Associate Professor

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Thomas L. Jordan, B.A., Rockhurst College; M.S., Ph.D., University of Wisconsin, Madison; Washington-Seattle; Associate Professor

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**Department:** Chemistry

**Chair:** Dr. Claude Lamb

Foluso Adebodun, B.S., Jersey City State College; M.S., Rutgers University; Ph.D., Rutgers University; Assistant Professor, Biochemistry

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Claude N. Lamb, B.S., Mount Union College; M.S., North Carolina Central University; Ph.D., Howard University; Associate Professor

Abdul K. Mohammed, B.Sc., University of Benin; Ph.D., Louisiana State University; Assistant Professor, Inorganic Chemistry

Yongmei Wang, B.S., The Science and Technology University of China, Ph.D., The University of Notre Dame, Assistant Professor, Physical Chemistry

Alex N. Williamson, B.S., Jackson State University; Ph.D., University of Illinois; Associate Professor and Chairman

**Department:**     **English**  
**Chair:**           **Dr. Elon Kulii**

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Brian Benson, A.B., Guilford College; M.A., University of North Carolina at Greensboro; Ph.D., University of South Carolina; Professor

Patricia E. Bonner, B.A., University of Alabama; M.A., Atlanta University; Ph.D., University of South Florida; Associate Professor

Jane Gibson Brown, B.A., Converse College; M.A., Vanderbilt University; Ph.D., University of Dallas; Associate Professor

Samuel Garren, B.A., Davidson College; M.A., Ph.D., Louisiana State University; Professor

Michael Greene, B.A., Duke University; M.A., Ph.D., Indiana University; Professor

Elon Kulii, A.B., Winston-Salem State University; M.S., North Carolina A&T State University; Ph.D., Indiana University; Professor and Chair

Gibreel M. Kamara, B.A., M.A., North Carolina A&T State University; Ed.D., Temple University; Assistant Professor

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**Department:** History  
**Chair:** Dr. Olen Cole

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Margaret L. Barrett, B.S., University of Southern Mississippi; M.A., Southern Illinois University; Ph.D., University of Missouri at Columbia; Associate Professor  
Fuabeh P. Fonge, B.A., The University of Yaounde; M.A., Georgetown University; Ph.D., Howard University; Associate Professor  
Peter V. Meyers, B.A., Wesleyan University; M.A., Ph.D., Rutgers University; Professor  
Conchita F. Ndege, B.F.A., Xavier University; M.A., Ph.D., Howard University; Director of the African Heritage Center and Associate Professor  
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**Department:** Mathematics  
**Chair:** Dr. Wilbur Smith

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Joseph R. Gruendler, B.S., M.S., Ph.D., University of Wisconsin, Ph.D., University of North Carolina at Chapel Hill; Adjunct Professor  
Alexandra Kurepa, B.S., M.S., University of Zagreb, Ph.D., University of Northern Texas; Associate Professor  
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**Department:      Physics**  
**Chair:              Dr. Caesar Jackson, (Interim)**

Abdellah Ahmidouch, B.S., Mohammed V. University; M.S., Joseph Fourier Grenoble University; Ph.D., University of Geneva; Assistant Professor

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Sekazi K. Mtingwa, B.S., Massachusetts Institute of Technology; M.A., Ph.D., Princeton University; Professor

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Thomas R. Sandin, B.S., Santa Clara University; M.S., Ph.D., Purdue University; Professor

Aaron Titus, B.S., Pennsylvania State University; Ph.D., North Carolina State University, Assistant Professor

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**Department:      Sociology & Social Work Joint Master of Social Work**  
**Chair:              Dr. Sarah Kirk**

Fasihuddin Ahmed, B.A., Forman Christian College; M.A., University of the Punjab; Ph.D., University of Chicago; Professor

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- David Johnson, B.A., Hamilton College; M.A., University of North Carolina at Chapel Hill; Ph.D., University of North Carolina at Chapel Hill; Associate Professor
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- \*Wayne Moore, B.S., East Carolina University; M.S.W., Ohio State University; Ph.D., University of South Carolina; Assistant Professor
- Ernest Morant, B.A., Claflin College; M.S.W., New York University; Assistant Professor
- June Murray, B.S., State University of New York-College of Old Westbury; M.S.W., Columbia University; M.S., University of California-Santa Cruz; Ph.D., University of California-Berkeley; Assistant Professor
- Velma Tyrance, B.S., Tuskegee University; M.S.W., Fordham University; Assistant Professor
- \*John Steele, B.A., Maryville College; M.S.S.W., Virginia Commonwealth University; D.S.W., Catholic University of America; Assistant Professor
- \* Primary assignment — the Joint Master of Social Work Program

## **ADJUNCT GRADUATE FACULTY - UNCG**

- \*Jacalyn Claes, B.S., Western Illinois University; M.S., Western Illinois University; M.S.W., University of Iowa; Ph.D., University of Iowa; Assistant Professor
- \*Susan Dennison, B.S.W., University of Detroit; M.S.W., Barry University; Assistant Professor
- Marilyn Edwards, B.S.W., North Carolina A&T State University; M.S.W., University of North Carolina at Chapel Hill; Lecturer
- Elisabeth Hurd, B.A., Harvard University; M.S.S.A., Case Western Reserve University; Ph.D., University of Chicago; Assistant Professor
- \*Elizabeth Lindsey, Diplome, University of Lyon; B.A., University of North Carolina at Chapel Hill; M.S.W., University of Georgia; Ph.D., University of Georgia; Associate Professor
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- Robert Wineburg, B.A., Utica College; M.S.W., Syracuse University; Ph.D., University of Pittsburgh; Professor
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## **School of Business and Economics**

**Department:**      **Economics and Transportation/Logistics**  
**Chair:**              **Dr. Michael Simmons**

- Abdussalam Addus, B.A., Addis Ababa University; M.S., University of Wisconsin; Ph.D., Pennsylvania State University; Associate Professor
- Julian Benjamin, B.S., New York University; M.S., Ph.D., State University of New York at Buffalo; Professor



Mark Burkey, B.S., Appalachian State University; Ph.D., Duke University, Assistant Professor  
 David Chen, B.S., National Taiwan University; M.S., New Mexico State University; Ph.D., University of Wisconsin; Associate Professor  
 Darnell Cloud, B.S., Florida A&M University; Ph.D., University of Wisconsin-Milwaukee; Assistant Professor  
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 Maury Granger, B.S., University of Louisville; M.A., Ph.D., University of Kentucky; Assistant Professor  
 Dong Jeong, B.A., Teachers College, Kyung-Pook National University, Korea; M.A., University of Hawaii; Ph.D., Wayne State University; Associate Professor  
 Anwar Khan, B.A., M.A., University of Punjab; M.A., Ph.D., University of Wisconsin; Professor  
 Vereda King, B.A., Johnson C. Smith University; M.B.A., North Carolina Central University; Ph.D., Duke University; Associate Professor  
 Lawrence Morse, B.A., Oberlin College; Ph.D., University of Minnesota; Associate Professor  
 Kofi Obeng, B.Sc., University of Science & Technology (Kumasi, Ghana); A.M., Ph.D., University of Pennsylvania; UPS Chair, Professor  
 \*Gregory Price, B.S., Morehouse; M.A., Ph.D., University of Wisconsin at Milwaukee; Associate Professor  
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 Scott Simkins, B.A., St. John's University; Ph.D., University of Iowa; Associate Professor  
 Michael Simmons, B.S., Arkansas A&M; M.A., University of Wisconsin; Ph.D., Washington State University; Assistant Professor and Chairperson  
 \*On leave, 2001-2002

**Department:**      **Business Administration**  
**Chair:**              **Dr. Paul G. Simmonds**

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 Betty L. Brewer, B.S., East Carolina Univ., M.B.A., D.B.A., Kent State University; Associate Professor  
 James R. Brown, Jr., B.S., M.S., University of Tennessee at Knoxville; Ed.D., University of Georgia; Associate Professor  
 Kathryn E. Dobie, B.M., Wittenburg University; A.S., Dalton College; M.B.A., University of Central Arkansas; Ph.D., University of Memphis; Associate Professor  
 Roger J. Gagnon, B.S., Boston University; M.B.A., Clark University; Ph.D., University of Cincinnati; Associate Professor  
 Lawrence M. Glisson, B.S., M.A., East Carolina University; M.B.A., Ph.D., The American University; Professor and Director of the MSM Program  
 Alan J. Greco, B.S., Utica College of Syracuse University; M.B.A., State University of New York at Buffalo; D.B.A., Mississippi State University; Associate Professor

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Robert Yerex, B.S., M.S., University of Minnesota; M.B.A., Ph.D., Cornell University; Associate Professor

## School of Education

**Department:** Curriculum and Instruction  
**Chair:** Dr. Dorothy Leflore (Interim)

- Treana Adkins-Bowling, B.S., Delaware State College; M.Ed., Salisbury State University; Ed.D., Virginia Polytechnic Institute and State University; Associate Professor (Elementary Education)
- David Boger, B.S., Livingstone College; M.S., New Mexico Highlands University; Ph.D., University of New Mexico; Professor (Elementary Education)
- Carlous Caple, B.A., North Carolina Central University; M.A.Ed., North Carolina Central University; Ed.D., North Carolina State University; Adjunct Assistant Professor (Instructional Technology)
- Elizabeth Jane Davis-Seaver, B.A., Duke University; M.Ed., University of Virginia; Ph.D., University of North Carolina at Greensboro; Assistant Professor (Elementary Education)
- Stephen Gareau, B.Comm., Queen's University; M.A., Concordia University; Ph.D., Mississippi State University; Adjunct Assistant Professor (Instructional Technology)
- Karen D. Guy, B.S., North Carolina A&T State University; M.Ed., North Carolina Central University; Ed.D., University of North Dakota; Director of Student Teaching and Educational Internships; Assistant Professor (Elementary Education)
- Pamela I. Hunter, B.A., Livingstone College; M.Ed., University of North Carolina at Greensboro; Ph.D., Ohio State University; Elementary Education Coordinator; Associate Professor (Elementary Education)
- Muktha Jost, B.A., Madras University; M.S., University of Kansas; Ph.D., Iowa State University; Assistant Professor (Instructional Technology)
- Cathy Kea, B.A., North Carolina Central University; M.S., University of Wisconsin-LaCrosse; Ph.D., University of Kansas; Associate Professor (Special Education)
- Dorothy D. Leflore, B.S., Mississippi Valley State University; M.S., University of Oregon; Ph.D., University of Oregon (Foundations); Interim Chairperson
- Marshena McCoy-Williams, B.A., Boston University; M.Ed., University of Massachusetts at Amherst; Ed.D., University of Massachusetts at Amherst; Assistant Professor (Reading)
- Morris C. Peterkin, B.S., Cheyney State College; M.S., Governors State University; M.Ed., Certificate, Temple University; Ph.D., University of Pittsburgh; Associate Professor (Cross-Categorical Special Education)
- Larry Powers, B.S., M.Ed., Tuskegee University; Ph.D., Michigan State University; Associate Dean and Associate Professor
- Earnestine Psalmonds, B.S., Tuskegee University; M.Ed., Tuskegee University; Ph.D., Georgia State University; Vice Chancellor for Research
- Karen Smith-Gratto, B.A., Christopher Newport College; M.A., Ph.D., University of New Orleans; Associate Professor (Instructional Technology)
- Thomas J. Smith, B.A., Manchester College; M.S., Indiana University; Ph.D., University of South Carolina; Assistant Professor (Foundations)
- Mary Todd-Allen, B.S., Radford University; M.S., Virginia Polytechnic Institute and State University; Adjunct Assistant Professor (Special Education)
- Genevieve L. Williams, B.A., Bennett College; M.S., North Carolina A&T State University; Ph.D., Ohio State University; Assistant Professor (Reading Education)
- Fred S. Wood, Jr., B.S., M.S., North Carolina A&T State University; Ed.D., University of North Carolina at Greensboro; Assistant Dean and Assistant Professor

**Department: Health, Physical Education**  
**Chair: Dr. Deborah Callaway**

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Tova R. Rubin, B.F.A., University of the Arts; M.A., Adelphi University; Ph.D., Temple University; Associate Professor

**Department: Human Development and Services**  
**Chair: Dr. Wyatt Kirk**

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Rosemary B. Closson, B.S., Howard University; M.B.A., Nova Southeastern University; Ph.D., Florida State University; Assistant Professor  
Fort, Edward B., B.S., M.Ed., Wayne State University; Ed.D., University of California, Berkeley; Professor and Chancellor Emeritus  
Brenda S. Hall, B.A., M.Ed., Shippensburg University; Ed.D., Virginia Polytechnic Institute and State University; Assistant Professor  
Wyatt D. Kirk, B.S., M.S., Ed.D., Western Michigan University; Associate Professor and Chairperson  
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### **College of Engineering**

**Department: Architectural Engineering**  
**Chair: Dr. Peter Rojeski, Jr.**

Ronnie S. Bailey; B.S. Arch., Howard University; M.U.P., University of Wisconsin-Milwaukee, Architecture; Associate Professor



Sameer A. Hamoush, P.E.-NC; Assistant Professor; B.S.C.E., University of Damascus (Syria); M.S.C.E., University of Nebraska; Ph.D.-C.E., North Carolina State University, Structures  
 Ronald N. Helms-P.E.-CO; B.Arch., University of Illinois; M.S.A.E., University of Illinois; Ph.D., Ohio State University, Lighting and Facilities; Chairperson and Professor  
 W. Mark McGinley, P.E.-NC; B.S.C.E., University of Alberta; M.S.C.E., University of Alberta; Ph.D.-C.E., University of Alberta, Structures; Associate Professor  
 Peter Rojeski, Jr., P.E.-NC; B.S.C.E., Clarkson College of Technology; M.S.M.E., Cornell University; Ph.D., Cornell University, Facilities and HVAC; Associate Professor  
 Harmohindar Singh, P.E.-NC; B.S.M.E., Punjab University; M.S.M.E., Punjab University; M.S.M.E., Wayne State University; Ph.D.-Mechanical Engineering, Wayne State University; HVAC, Professor  
 Reginald Whitsett; B.S.A.E., NCA&T State University; M.Arch., North Carolina State University, Architecture; Associate Professor

**Department:** Chemical Engineering  
**Chair:** Dr. Franklin King

Yusuf G. Adewuyi, B.S., Ohio University; M.S., Ph.D., University of Iowa; Associate Professor  
 Vinayak N. Kabadi, B.ChE, Bombay University; M.S., S.U.N.Y. at Buffalo; Ph.D., Pennsylvania State University; Professor  
 Franklin G. King, B.S., Pennsylvania State University; M.S., Kansas State University; M.Ed., Howard University; D.Sc., Stevens Institute of Technology; Professor and Chairman  
 Shamsuddin Ilias, B.S., Bangladesh University of Engineering and Technology, Dhaka; M.S., University of Petroleum and Minerals, Dhahran; Ph.D., Queen's University, Canada; P.E.; Associate Professor  
 Kenneth L. Roberts, B.S., M.S., Georgia Tech; Ph.D., University of South Carolina; Assistant Professor  
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 Gary B. Tatterson, B.S., University of Pittsburgh; M.S., Ohio State University; Ph.D., Ohio State University; P.E.; Professor

**Department:** Civil and Environmental Engineering  
**Director:** Dr. Emmanuel Nzewi

Shoou-Yuh Chang, B.S., M.S., National Taiwan University; M.S., University of North Carolina; Ph.D., University of Illinois; Professor  
 Kenneth H. Murray, B.S., M.S., Ph.D., Virginia Polytechnic Institute and State University; Chairman and Professor  
 Richard E. Norris, B.S., Washington State University; M.S., D.Eng., University of California at Berkeley; Assistant Professor  
 Emmanuel Nzewi, B.S., Michigan Technological University; M.S., Ph.D., Purdue University; Associate Professor  
 Miguel Picornell, B.S., Madrid Polytechnic University; M.E., Ph.D., Texas A&M University; Professor and Chairperson  
 M. Reza Salami, B.S., M.S., Virginia Polytechnic Institute and State University; Ph.D., University of Arizona; Professor and Associate Dean for Research and Graduate Programs

**Department:**      **Computer Science**  
**Chair:**              **Dr. Kenneth A. Williams**

Sharon A. Brown, Assistant Professor and Acting Director of Undergraduate Studies; M.S., (1984) University of Illinois; Artificial Intelligence  
Christo Dichev, Ph.D., Kiev University; Artificial Intelligence, Reasoning, Logic Programming, Knowledge Representation  
Albert C. Esterline, Ph.D., University of Minnesota; Logic and Functional Programming, Artificial Intelligence, Automated Reasoning  
John Kelly, Jr., Ph.D., University of Delaware; Computer Network Performance Measurement and Modeling, Embedded Systems Design, Hardware Description Languages  
Mohammed Ketel, Ph.D., Polytechnic University; Computer Architecture, Computer Networks, Image Processing, Database Applications, Coding and Information Theory  
Joseph Monroe, Chairperson, Ph.D., Texas A&M University; Object Oriented Software Engineering, CASE Tools  
Kenneth A. Williams, Ph.D., University of Minnesota; Distributed Operating Systems, Optical Communications, Computer Architecture  
Sung Yoon, Ph.D., North Carolina State University; Multimedia Communication, Video Coding, Computer Vision  
Anna Huiming Yu, Ph.D., Stevens Institute of Technology; Artificial Intelligence, Software Engineering, Robotics

**Department:**      **Agricultural and Biosystems Engineering**  
**Director:**           **Dr. Godfrey Gayle**

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Manuel Reyes, B.S. and M.S., Philippines University at Los Banos; Ph.D., Louisiana State Associate Professor  
Abolghasem Shahbazi, B.S., Tabriz University; M.S., U. C. Davis, CA; Ph.D., Penn State University; Associate Professor, Graduate Coordinator

**Department:**      **Electrical Engineering**  
**Chair:**               **Dr. John Kelly, Chair**

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M. Bikdash, B.S., Ameri. U., Beirut; M.S., Ph.D., Virginia Tech., Blacksburg, Va.; Associate Professor  
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Shanthi Iyer, B.S., M.S., Delhi University; Ph.D., Indian Institute of Technology; Professor  
John Kelly, B.S., Ph.D., University of Delaware; Associate Professor

Jung H. Kim, B.S., Yonsei University; M.S., Ph.D., North Carolina State University; Professor

Gary L. Lebbby, B.S., M.S., University of South Carolina; Ph.D., Clemson University; Professor

Clinton B. Lee, B.S., California Institute of Technology; M.S., North Carolina A&T State University; Ph.D., North Carolina State University; Associate Professor

R. Li, B.S., Duke University; M.S., Purdue University; Ph.D., University of Kansas; Associate Professor

D.E. Olson, B.S. and M.S., Michigan Tech.; Ph.D., U. Utah; Associate Professor

Karim Salman, B.S. (Eng) (Hon), U. of London; M.S., Brunel University; Ph.D., Brunel University; Associate Professor

D. Song, B.S., Cheng Du U. Sci. Tech.; M.S., Chong Qing U.; Ph.D., Tennessee Technical; Associate Professor

Alvernon Walker, B.S., M.S., North Carolina A&T State University; Ph.D., North Carolina State University; Associate Professor

Chung Yu, B.S., McGill University; M.S., Ph.D., Ohio State University; Professor

**Department: Industrial & Systems Engineering**  
**Chair: Eui Park**

Abdullah Dasci, Assistant Professor, B.S., M.S., Bilkent University; Ph.D., McGill University.

Christopher Geiger, Assistant Professor, B.S., North Carolina A&T State University; Ph.D., Purdue University

Daniel N. Mountjoy, Assistant Professor, B.S., M.S., Wright State University; Ph.D., North Carolina State University

Celestine Ntuen, Professor, NCE (Mathematics/Physics) College of Education, UYO, Nigeria; BSIE, MSIE, Ph.D., West Virginia University

Herbert Nwankwo, Assistant Professor, NCE (Mathematics/Economics) University of Nigeria; B.S., Transportation, MSIE, North Carolina A&T State University; Ph.D., University of Texas, Arlington

Eui Park, Chairperson/Professor, B.S., Yonsei University; MSIE, Ph.D., Mississippi State University

Bala Ram, Professor/Professional Engineer, BSME, MSIE, Indian Institute of Technology, Madras; Ph.D., State University of New York at Buffalo, Professional Engineer in NC.

Sanjiv Sarin, Professor/Professional Engineer; BSChE, MSIE, Indian Institute of Technology, Delhi; Ph.D., University of New York, Professional Engineer in NC.

Paul Stanfield, Assistant Professor, B.S.E.E., North Carolina State University; MBA, University of North Carolina at Greensboro; M.S.I.E./O.R., Ph.D., North Carolina State University, Professional Engineer in NC.

Silvanus J. Udoka, Associate Professor, B.S., MSIE, Ph.D., Oklahoma State University

Kittinan Unnanon, Assistant Professor, B.S. Chulalongkorn University; M.S., Ph.D., North Carolina State University

Charles H. VandeZande, Adjunct Associate Professor, B.S. (Physics), Lawrence University; MSc. (Applied Statistics), Rutgers University

W.V. Yarbrough, Adjunct Assistant Professor, B.S., M.S., North Carolina A&T State University; Ph.D, Virginia Polytechnic Institute and State University

**Department:**      **Mechanical Engineering**  
**Chair:**              **Dr. William Craft**

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- William J. Craft, P.E.; B.S., North Carolina State University; M.S. & Ph.D., Clemson University; Professor and Chairperson
- DeRome O. Dunn, B.S., M.S., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University; Associate Professor
- Frederick Ferguson, M.S., Kharkov State University; Ph.D., University of Maryland; Associate Professor and Director of NASA/CAR
- George J. Filatovs, B.S., Washington University; Ph.D., University of Missouri at Rolla; Professor
- Meldon Human, P.E.; B.S., Northwestern University; M.S., Ph.D., Stanford University; Associate Professor
- Ajit D. Kelkar, B.S., Poona University; M.S., South Dakota State University; Ph.D., Old Dominion University; Associate Professor
- David E. Klett, P.E.; B.S., Michigan State University; M.S., Ph.D., University of Florida; Professor
- Richard A. Layton, P.E.; B.S., California State University, Northridge; M.S., Ph.D., University of Washington; Assistant Professor
- Carolyn W. Meyers, B.S.M.E., Howard University; M.S., Ph.D., Georgia Institute of Technology; Professor and Interim Vice Chancellor for Academic Affairs
- Tony C. Min, P.E.; B.S., Chiao Tung University; M.S., Ph.D., University of Tennessee, Professor Emeritus
- Samuel P. Owusu-Ofori, P.E.; B.S., University of Science and Technology - Kumasi, Ghana; M.S., Bradley University; Ph.D., University of Wisconsin at Madison; Boeing Professor of Manufacturing
- Devdas M. Pai, P.E.; B.S., Indian Institute of Technology, Madras; M.S., Ph.D., Arizona State University; Associate Professor
- Japannathan Sankar, B.E., University of Madras; M.E., Concordia University; Ph.D., Lehigh University; Professor
- Lonnie Sharpe, Jr., P.E.; B.S., North Carolina A&T State University; M.S., North Carolina State University; Ph.D., University of Illinois-Urbana, Champaign; Professor and Dean, College of Engineering
- K. N. Shivakumar; B.E., Bangalore University; M.E., Ph.D., Indian Institute of Science; Research Professor
- Shih-Liang Wang, P.E.; B.S., National Tsing Hua University; M.S., Ph.D., Ohio State University; Associate Professor



## School of Technology

**Department:** Manufacturing Systems  
**Chair:** Dr. Marcus D. Tillery (Interim)

William K. James, A.A., North Iowa Area Community College; B.S., Iowa State University; M.A., University of Northern Iowa; D.I.T., University of Northern Iowa; Associate Professor

Marcus Tillery; B.S., North Carolina A&T State University; M.S., Iowa State University; Ph.D., Iowa State University; Associate Professor and Interim Chairperson

Earnest L. Walker, B.S., A.M. & N. College; M.S., University of Arkansas, Fayetteville; Ph.D., Southern University at Carbondale, IL; Professor and Interim Associate Dean

**Department:** Electronics and Computer Technology  
**Chair:** Dr. Ray Davis (Interim)

DeWayne Brown, B.S.E.E., University of South Carolina; M.S.E.E., North Carolina A&T State University; Ph.D., Virginia Polytechnic Institute and State University; Assistant Professor

Derrek Dunn, B.S.E.E. and B.S. Mathematics, North Carolina A&T State University; M.S.E.E., M.S. Mathematics, Ph.D., Virginia Polytechnic Institute and State University; Assistant Professor

Fereshteh Fatehi, B.S.E.E., Shiraz University; M.S.E.E., Ph.D.E.E., Montana State University; Associate Professor

Tijjani Mohammed, B.S., Central Missouri State; M.S., Indiana State; Ph.D., Texas A&M University; Assistant Professor

Veeramuthu Rajaravivarma, B.S.E.E., M.S.E.E., University of Madras; MASC (EE), University of Windsor; Ph.D., Tennessee Technological University; Professor

John Spurlin, B.S.E.E., Cook Institute; M.S.C.E., M.Ed., Ph.D., Wayne State University; Professor

**Department:** Construction Management  
**Chair:** Dr. David Dillon (Interim)

Robert B. Pyle, B.A., M.A., Trenton State College; Ph.D., University; Professor

Musibau A. Shofoluwe, B.S., North Carolina A&T State University; M.S., Pittsburgh State University; DIT, University of Northern Iowa; Professor

**Department:** Occupational Safety & Health  
**Chair:** David Dillon (Interim)

Dilip T. Shah, B.E., Poona, India; M.S., Illinois State University; Ph.D., Texas A&M University; Associate Professor

Syrulwa L. Somah, B.S., Empire State College State University of New York; M.S., Central Michigan University; M.S., University of Oklahoma; Ph.D., The Union Institute; Assistant Professor

**Department:**      **Graphic Communication Systems and Technological Studies**  
**Chair:**              **Dr. Nancy Glenz**

Elazer Barnette, B.S., West Virginia State College; M.S., North Carolina State University; Eh.D., North Carolina State University; Professor and Dean

Vincent W. Childress, B.S.Ed., M.S.Ed., Ph.D., Virginia Polytechnic Institute and State University; Assistant Professor

Ray Davis, B.S., University of Maryland Eastern Shore; M.S., Ph.D., The Ohio State University; Professor and Associate Dean

Cynthia Gillispie-Johnson, B.S., North Carolina A&T State University; M.S., University of North Carolina at Greensboro; Ph.D., Virginia Polytechnic Institute and State University; Assistant Professor

Nancy L. Glenz, B.S., Trenton State College; M.S., Ph.D., Michigan State University; Professor, Chairperson

Arjun Kapur, B.S., M.S., Ponjob University; Ph.D., Indian Institute of Technology; Associate Professor

Devang Mehta, B.S., University of Bombay; M.A. and ABD for D.I.T., University of Northern Iowa; Adjunct Assistant Professor

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Gretchen Bataille, Senior Vice President for Academic Affairs  
Jeffrey Davies, Vice President for Finance and Chief Information Officer  
Ronald Penny, Vice President for Human Resources  
Robyn Render, Interim Vice President for Information Resources and Chief Information Officer  
Leslie Winner, Vice President and General Counsel  
Gary Barnes, Vice President for Program Assessment and Public Service  
James B. Milliken, Vice President for Public Affairs and University Advancement  
Rosalind Fuse-Hall, Secretary of the University  
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## **MISSION, PURPOSE AND GOALS OF THE UNIVERSITY**

### **Mission Statement**

North Carolina Agricultural and Technical State University is a public, comprehensive, land-grant university committed to fulfilling its fundamental purposes through exemplary undergraduate and graduate instruction, scholarly and creative research, and effective public service. The University offers degree programs at the baccalaureate, master's, and doctoral levels with emphasis on engineering, science, technology, literature, and other academic areas. As one of North Carolina's three engineering colleges, the University offers Ph.D. programs in engineering. Basic and applied research is conducted by faculty in University centers of excellence, in interinstitutional relationships, and through significant involvement with several public and private agencies. The University also conducts major research through engineering, transportation, and its extension programs in agriculture.

For the present planning period (2001-2003), the University will continue to place emphasis on strengthening its programs in engineering, the sciences, and technology. The University also offers, in conjunction with the University of North Carolina at Greensboro, a joint master's degree program in social work.

The purpose of the University is to provide an intellectual setting where students in higher education may find a sense of identification, belonging, responsibility, and achievement that will prepare them for roles of leadership and service in the communities where they will live and work. In this sense, the University serves as a laboratory for the development of excellence in teaching, research, and public service.

The program of the University focuses on the broad fields of agriculture, engineering, technology, business, education, nursing, the liberal arts, and science.

The major goals of the University as approved by the faculty are as follows:

1. To help students improve their interpersonal and communication skills.
2. To ensure adequate career preparation for students that will enable them to lead productive lives.
3. To develop innovative instructional programs that will meet the needs of a diverse student body and the expectations of the various professions.



4. To maintain an environment which fosters quality instruction, encourages the further professional development of faculty and staff, and supports the ideals of academic freedom and shared governance.
5. To assist students in developing their powers of critical and analytical thinking.
6. To promote managerial efficiency in all administrative functions, including the continued development of operational efficiency and productivity in the accounting and fiscal system of the University consistent with the needs of the various University programs and functions and with the expectations of state and federal regulations.
7. To assist students in developing in-depth competence in at least one subject area for a global economy and for an environment with changing technology.
8. To aid students in the further development of self-confidence and a positive self-image.
9. To identify and secure additional sources for internal and external funds to support the development of competitive financial aid awards to academically qualified students and to needy students.
10. To further develop and maintain the institutional research and planning processes that are necessary for the continued competitiveness, relevance, productivity, and credibility of the University, its programs, and its operations.
11. To develop and maintain undergraduate and graduate programs of high academic quality and excellence.
12. To encourage research and other creative endeavors by the faculty and students.
13. To identify and help satisfy educational, cultural, and other public service needs in the state, nation, and international environment.
14. To plan, construct, and maintain physical facilities for the achievement of the goals of the educational programs, research, and administrative functions.

## **POLICY GOVERNING PROGRAMS AND COURSE OFFERINGS**

All provisions, regulations, degree programs, course listings, etc., in effect when this catalogue went to press are subject to revision by the appropriate governing bodies of North Carolina Agricultural and Technical State University. Such changes will not affect the graduation requirements of students who enroll under the provisions of this catalogue.

### **Piedmont Independent College Association of North Carolina**

The Piedmont Independent College Association of North Carolina is an organization comprised of North Carolina Agricultural and Technical State University, The University of North Carolina at Greensboro, High Point College, Greensboro College, Bennett College, Guilford College, and Guilford Technical Community College. The organization promotes interinstitutional cooperation and cooperative educational activities among the seven institutions. Agreements provide the opportunity for any student to enroll at another institution for a course or courses not offered on one's home campus.

## **RESOURCES AND STUDENT SERVICES**

### **Office of Development and University Relations**

The Office of Development and University Relations assists with the overall institutional development, but also promotes the University's continual interest among alumni, parents, friends, prospective and current students, foundations, corporations and other sectors of the national community. It encourages annual alumni giving and deferred giving, and conducts a variety of fund-raising campaigns. The office embraces two main areas of operation: Development and University Relations. The Development operation includes Alumni Affairs, Advancement Services, Corporate/Industry Cluster, Legislative Relations, Special Educational Projects and Special Events. The University Relations department includes Community Relations, Public Information, Publications, Public Relations, Marketing and Sports Publicity.

In addition, the office aids in conducting the affairs of the North Carolina A&T University Foundation, Inc., which has been established to assist in soliciting gifts, grants and contributions from public and private sources for such worthy purposes as student scholarships, faculty development, library resources, specialized equipment and cultural and public service programs.

The Development offices are located in Suite 400 of the Dowdy Administration Building. The University Relations department is located in the Garrett House on Nocho Street next to Murphy Hall.

### **Division of Research**

The Division of Research administers and manages research and sponsored programs as well as intellectual property for the University. Headed by the Vice Chancellor for Research, the organizational structure consists of an Office of Research Services, Office of Sponsored Programs, and an Office of Technology Transfer and Commercialization. The Vice Chancellor is responsible also for managing research centers and institutes, including the Edward B. Fort Interdisciplinary Research Center (IRC), a dedicated research facility that supports multidisciplinary applied research through twenty-one specialized laboratories. The Division serves as a major service unit for the entire University and delivers the following: dissemination of funding opportunity information, program design and development support, administrative liaison for external agencies, technical assistance with agency guidelines and regulations, training in proposal development and project management, marketing of research capabilities, negotiation of agreements, assurance of research compliance, implementation of electronic research administration, support of research centers and institutes, maintenance of a repository of sponsored program information, and management of intellectual property. The Division develops and implements policies, procedures, and administrative support systems for research and other sponsored programs.

### **Food Services**

The University provides food services for students at a reasonable cost. Several snack bar options are located in the Memorial Student Union Building. Students who live in the residence halls are required to purchase a meal plan; several options are available (minimum 10//week). Students who live off campus may also purchase meals or a meal plan.

## **Housing And Residence Life**

<http://www.ncat.edu/~housing/>

The Department of Housing and Residence Life exists as an integral part of the educational program and academic support services of North Carolina Agricultural and Technical State University.

Its mission includes providing a good living and learning environment and related educational programs which support the educational goals of our students and the University.

## **Office of Career Services**

The mission of the Office of Career Services (OCS) of North Carolina Agricultural and Technical State University is to provide centralized, comprehensive and progressive programs, services, and resources designed to prepare students to successfully pursue meaningful career opportunities. Continuous career development assistance is also available to alumni of the University.

Career Services is customer focused and centralizes the functions of off-campus student employment (*full-time employment, summer jobs, internships, cooperative education, part-time employment*) and career counseling. Students and employers are given professional and competent assistance to reach their specific employment needs. Services of the Office include the following:

- Act as liaison between students and employers, acquainting them with career opportunities.
- Work with academic deans, faculty members and administrators to help bridge the gap between the classroom and the world of work.
- Assist students through individual and group counseling.
- Help students and alumni in identifying career search strategies.
- Provide cooperative education experiences.

Services are always performed with a conscientious and sincere interest in the students as well as the prospective employers.

The Office of Career Services is located in Room 101, Murphy Hall. Its website can be accessed at [www.careerserv.ncat.edu](http://www.careerserv.ncat.edu).

## **Student Organizations and Activities**

The University provides a well-balanced program of activities for moral, spiritual, cultural, and physical development of the students. Religious, cultural, social, and recreational activities are sponsored by various committees, departments, and organizations of the University. Outstanding artists, lecturers, and dramatic productions are brought to the campus.

A listing of student organizations, their purposes, objectives, chief officers, and advisors is published annually by the Office of the Assistant Vice Chancellor for Student Development. This document is available upon request by any office individual.

## **The Memorial Union**

The Memorial Union functions as the “community center” for the University and its constituency by providing a diversity of services and activities. The “Union” building encompasses over 60,000 square feet of space and serves as the headquarters for the Student Government Association, Student Union Advisory Board, Office of Student Activities, Aggie Escort Service, Yearbook Staff, Intramural Sports, Minority Student Affairs and the Commuter Student Center. Also, the Memorial Union offers room accommodations for small group meet-

ings or large banquet activities, lounge areas, self-service vending, Aggie One Card services, ATM services, fax services, a food court, games room, copier corner, art displays, and the Information Center.

A primary goal of the Memorial Student Union is to promote an involved community through its various services, facilities, and programs. The Union's location in the heart of the north campus provides a co-curricular community for students, faculty members, alumni, and guests served by the University. Additionally, the programming and recreational activities of the Student Union Advisory Board have a unique focus on the cultural and social development of participants.

### **Veterans' Affairs and Disability Support Services**

North Carolina A&T State University is an approved University for veterans and veteran dependents who wish to attend and receive educational benefits.

Persons wishing to attend the University under the Veterans' Administration Educational Training Program should apply to the Veterans' Administration for a Certificate of Eligibility. Simultaneously, they should apply for admission to North Carolina A&T State University through normal admissions procedures. The issuing of a Certificate of Eligibility by the Veterans' Administration does not automatically assure a student of admission to the University.

The office is located in Suite 005, Murphy Hall, and has been established to assist veterans with enrollment and adjustment to college life. Upon enrolling at the University, veterans or eligible persons should report to the Office of Veterans' Affairs for certification. If a Certificate of Eligibility has not been issued, the veterans or the eligible persons should see the University Certifying Official.

### **Disability Support Services**

The Office of Disability Support Services is established to assure ready accessibility of all academic programs, services, and activities, to any person with a disability matriculating at the University. Likewise, it focuses on facility accessibility.

The Office serves as a liaison for all students with disabilities as they participate in programs and activities enjoyed by all students. Additionally, the office arranges for any needed academic adjustments and/or reasonable accommodations. Documentation is required.

All information and services for persons with disabilities are handled through this office located in Suite 005, Murphy Hall. Students are encouraged to take advantage of these services.

### **Minority Affairs**

The Office of Minority Student Affairs was created in order to assist minority (Native and Asian American, Caucasian and Hispanic/Latino) students in the development and accomplishment of their educational goals. Housed in Suite 219 of the Memorial Union, Minority Student Affairs is open from 8:00 a.m. to 5:00 p.m. and is staffed by the director and secretary.

Minority students represent approximately twelve percent (12%) of the student population. This means about 850 minority students are enrolled at North Carolina Agricultural and Technical State University. Efforts to serve these students are designed to increase the retention and graduation of minority presence students through activities, newsletters, workshops, mentoring programs, surveys, counseling, and numerous program outreach services that focus on personal development and campus involvement.



The Minority Student Association offers leadership opportunities and social activities for minority students, often in cooperation with other campus organizations.

### **Bookstore**

The Bookstore is responsible for selling and distributing textbooks, study aids, student supplies, departmental supplies, and souvenirs to the students, faculty, and staff. The bookstore is located in the Brown Hall. The telephone number is 336-334-7593.

### **Student Development Services**

The Division of Student Affairs shoulders the major responsibility for Student Development Services. The Vice Chancellor for Student Affairs is the Chief Administrative Officer. The division is comprised of fourteen departments assigned to four major units that are supervised by the Assistant Vice Chancellor for Student Development, Assistant Vice Chancellor for Career Services, Associate Vice Chancellor for Student Affairs, and Director of Housing.

Student Development Services at the University are organized for the purpose of providing programs and services that complement the academic mission of the University and contribute to the intellectual, social, moral, cultural, and physical development of students. These programs and services are designed to meet the expressed out-of-classroom needs of students while they pursue academic careers at the University.

As a support unit to the academic process, Student Affairs works with students in areas of counseling, leadership development, housing, and student activities. Such activities assist students in finding a sense of belonging, responsibility, and achievement. The Division carries out its purpose through goals given below:

1. To provide leadership development opportunities for student leaders, Student Government Association, Student Union Advisory Board, and other student organizations such as sororities and fraternities.
2. To provide improved services for students that impact upon their personal development.
3. To develop activities and programs that accommodate the special needs of commuter and adult students.
4. To provide programs to accommodate the special needs of minority students.

Consistent with the overall goals of the University, Student Development Services include the following programs and activities: (1) Counseling Services, (2) Career Services, (3) Student Government Association, (4) Student Activities and Publications, (5) Health Services, (6) Intramural Sports, (7) Veterans and Disabilities Support Services (8) Student Support Services, (9) Housing and Residence Life, (10) Student Union, (11) International Student Affairs, (12) Upward Bound Program, (13) Student Development, and (14) Minority Affairs.

Some of the specific services are described below:

### **Counseling Services**

The University makes provisions for counseling, testing, and guidance for all students through Counseling Services, located in 108 Murphy Hall.

Counseling Services conducts a testing program for all freshman students. The results of this program are used to assist freshmen in the planning of their educational and vocational careers. The Office conducts other testing programs that are required or desired by the departments of the University.

Counseling Services offers students the opportunity to discuss with a trained professional counselor or clinical psychologist any questions, dilemmas, needs, problems, or concerns in-

volving educational, career, social, personal, or emotional adjustment that may occur during the college years.

The following is a list of services available through Counseling Services:

1. Individual and group personal counseling.
2. Academic and Career Counseling.
3. Individual test administration and interpretation covering the areas of intelligence, aptitude, personality, interest, achievement, and other areas requiring special needs.
4. University Diagnostic and Placement Testing Program for all freshmen to assist in the planning of their educational and vocational careers and other programs required or desired by departments of the University.
5. College Level Examination Program (CLEP) for Course Credit by Examination.
6. National Testing Program which includes administration of the Graduate Record Examinations, National Teacher Examinations, Graduate Management Admission Test, Veterinary College Admissions Test, and other similar examinations.
7. Graduate student internship training laboratory.
8. Graduate school information and cooperation in the placement of graduates who desire to pursue graduate studies.
9. Withdrawal exit interviews.
10. Outreach counseling programs and activities.

All counseling is voluntary, free of charge, private, and confidential.

# DRUG AND ALCOHOL EDUCATION POLICY

## Preamble:

The basic mission of North Carolina Agricultural and Technical State University is to provide an educational environment that enhances and supports the intellectual process. The academic community, including students, faculty, and staff, has the collective responsibility to ensure that this environment is conducive to healthy intellectual growth. The illegal use of harmful and addictive chemical substances and the abuse of alcohol pose a threat to the educational environment. Thus, this Drug and Alcohol Education Policy is being promulgated to assist members of the University community in their understanding of the harmful effects of illegal drugs and alcohol abuse; of the incompatibility of illegal drugs and the abuse of alcohol with the educational mission of the University; and of the consequences of the use, possession, or sale of such illegal drugs, and the abuse of alcohol, including the violation of applicable laws.

## Objectives:

- I. To develop an educational program that increases the University community's knowledge and competency to make informed decisions relative to the use and abuse of controlled substances and alcohol; and
- II. To increase those skills and attributes required to take corrective action conducive to the health and well being of potential drug and alcohol abusers.

## Program Components:

There are five (5) components to this policy:

- I. Education
- II. Health Risks
- III. Rehabilitation
- IV. Sanctions
- V. Dissemination and Review.

## I. EDUCATION

It is the intent of the Drug and Alcohol Education Policy of North Carolina A&T State University to ensure that all members of the University community (i.e., students, faculty, administrators, and other employees) are aware that the use, sale, and/or possession of illegal drugs and the abuse of alcohol are incompatible with the goals of the University. Moreover, each person should be aware that the use, sale, or possession of illegal drugs and the abuse of alcohol is, as more specifically set forth later in this policy, subject to specific sanctions and penalties.

Each member of the University family is reminded that in addition to being subject to University regulations and sanctions regarding illegal drugs and the abuse of alcohol, he/she is also subject to the laws of the State and of the nation. Each individual is also reminded that it is not a violation of "double jeopardy" to be subject to the terms of this policy as well as the provisions of the North Carolina General Statutes. For a listing of relevant State criminal statutes, please see Appendix A. Further questions may be directed to the Office of the University Attorney or the Office of Student Affairs.

Each member of the University community is asked to pay particular attention to the full consequences of the sanctions specified in this policy, as well as to the consequences of the North Carolina criminal law referenced above. Certain violations may jeopardize an individual's future as it relates to continued University enrollment or future employment possibilities, depending on individual circumstances.

Further, it is a policy of the University that the educational, legal, and medical aspects of this issue be emphasized on an annual basis through the provision of programs and activities in the following areas:

- (a) Annual Drug and Alcohol Education Week - Workshops and seminars on drug abuse led by former drug addicts and community agencies such as MADD, SADD, and the Sycamore Center;
- (b) Drug and Alcohol Awareness Fair - Exhibits featuring drug and alcohol related paraphernalia;
- (c) Media presentations on University radio station, WNAA, emphasizing the most current programs with drug and alcohol education messages;
- (d) "Home for the Holidays, Don't Drink and Drive"; Drug and Alcohol Abuse Prevention Campaign;
- (e) Publication of brochure on drug education;
- (f) Continual monthly outreach programs in each residence hall.

Although directed primarily to the student population, these educational programs shall also be open to participation by all categories of University employees.

Additionally, the Staff Development Office is the designated University department responsible for the planning and implementation of drug and alcohol education programs geared toward the special needs of the faculty and staff. Among the programs to be implemented by the Staff Development Office are lunchtime seminars jointly conducted by the Sycamore Center, the Greensboro Police Department, and the Guilford County Mental Health Department.

## II. HEALTH RISKS

Health risks associated with the use of illicit drugs and the abuse of alcohol are wide-ranging and varied depending on the specific substance involved and individual abuse pattern. These risks include, but are not limited to the following:

1. Physical changes which alter bodily functions such as severely increased or decreased cardiac output; shallow to irregular respiration; and damage to other major organs, such as kidney, liver and brain;
2. Emotional and psychological changes including paranoia, depression, hostility, anxiety, mood swings, and instability;
3. Additional health risks could include such illnesses as AIDS-HIV infection, sexually transmitted diseases, severe weight loss, cancer, cirrhosis, hepatitis, short-term memory loss, seizures, and deformities to unborn children;
4. Physical and psychological dependency (addiction); and
5. Death from overdose or continual use.

While these health risks are broad in range, persons consuming illicit drugs and alcohol will experience some, if not all, of the above symptoms. See Appendix A for a list of a few specific drugs and their corresponding health risks.

## III. REHABILITATION

The University recognizes that rehabilitation is an integral part of an effective drug and alcohol policy. Consistent with its commitment in the areas of education and sanctions, the University intends to provide an opportunity for rehabilitation to all members of the University family. This commitment is evidenced through access to existing University resources and is furthered by referrals to community agencies.

### Students

The University Counseling Center and the Student Health Center are available to provide medical and psychological assessment of students with drug/alcohol dependency and drug/al-



cohol abuse problems. Based on the outcome of this assessment, treatment can be provided by either or both of these centers. If, however, the scope of the problem is beyond the capability of these Centers, affected students will be referred to community agencies such as the Guilford County Mental Health Center and Greenpoint. The cost of such services shall be the individual's responsibility.

## **Employees**

Referrals to local community agencies will be made available to include the Guilford County Mental Health Center, Greenpoint, and private physicians. The cost of such services will be the individual's responsibility. The services of the University's Counseling and Health Centers are not normally utilized by faculty and staff members except in emergency situations.

## **IV. SANCTIONS**

### **A. Illegal Drugs/Prohibited Conduct**

All members of the University community have the responsibility for being knowledgeable about and in compliance with the provisions of North Carolina Law as it relates to the use, possession, or sale of illegal drugs as set forth in Article 5, Chapter 90 of the North Carolina General Statutes. Any violations of this law by members of the University family subjects the individual to prosecution both by the University disciplinary proceedings and by civil authorities. It is not a violation of "double jeopardy" to be prosecuted by both of these authorities. The University will initiate its own disciplinary proceedings against a student, faculty member, administrator, or other employee when the alleged conduct is deemed to affect the interests of the University.

Penalties will be imposed by the University in compliance with procedural safeguards applicable to disciplinary actions against students (see the Student Handbook), faculty members (see the Faculty Handbook), administrators (see the Board of Governors Policies Concerning Senior Administrative Officers as well as the EPA Non-Teaching Personnel Policies), and SPA employees (see State Personnel Commission Policies).

The penalties imposed for such violations range from written warnings with probationary status to expulsion from enrollment and discharge from employment. However, minimum penalties that apply for each violation are listed in Appendix A. For additional information, direct questions to the Office of the University Attorney or the Office of Student Affairs. It should be noted that where the relevant sanction dictates a minimum of one semester suspension from employment, the regulations of the State Personnel Commission (as pertaining to SPA employees) do not permit suspension from employment of this duration. Thus, such sanction as applied to SPA employees dictates the termination of employment.

### **B. Alcohol/Prohibited Conduct**

#### **1. Employees**

While the sale, possession, or consumption of alcoholic beverages is not illegal under state or federal law, it is, hereby, the policy of North Carolina A&T State University that the consumption of alcohol sufficient to interfere with or prevent otherwise normal execution of job responsibilities is improper and subjects the employee to appropriate disciplinary procedures. It is also the policy of North Carolina A&T State University that alcoholic beverages not be sold on campus. Employees violating these policies are subject to appropriate disciplinary procedures, which may range from warning and probation to dismissal consistent with the individual circumstances.

Similarly, employees are reminded that, under N.C. Law, it is illegal to sell or give malt beverages, unfortified wine, fortified wine, spirituous liquor, or mixed beverages to anyone less than 21 years old. It is also illegal to aid and abet any person less than 21 years old in the

purchase or possession of these alcoholic beverages. Employees found violating these state laws are subject to legal sanction as well as the appropriate disciplinary procedures.

## 2. Students

Students are reminded of the following University regulations and state laws regarding alcoholic beverages as contained in the Student Handbook.

### 1. Students are liable for violation of State Law GS 18B-302 while on University premises: 18B-302 Sale to or Purchase by Underage Persons

#### a. Sale - It shall be unlawful for any person to

I. Sell or give malt beverages or unfortified wine to anyone less than 21 years old; or

II. Sell or give fortified wine, spirituous liquor, or mixed beverages to anyone less than 21 years old.

#### b. Purchase or Possession - It shall be unlawful for

I. A person less than 21 years old to purchase, to attempt to purchase, or to possess malt beverages, or unfortified wine; or

II. A person less than 21 years old to purchase, to attempt to purchase, or possess fortified wine, spirituous liquor, or mixed beverages.

#### c. Aider and Abettor

I. By Underage Person - Any person under the lawful age to purchase who aids or abets another in violation of subsection (a) or (b) of this section shall be guilty of a misdemeanor punishable by a fine of up to five hundred dollars (\$500.00) or imprisonment for not more than six months, or both, at discretion of the court.

II. By Person over Lawful Age - Any person who is over the lawful age to purchase who aids or abets another in violation of subsection (a) or (b) of this section shall be guilty of a misdemeanor punishable by a fine of up to two thousand dollars (\$2,000) or imprisonment for not more than two years, or both, at the discretion of the court.

### 1. Students are responsible for conforming to state laws pertaining to

a. Transportation of alcoholic beverages

b. Consumption of alcoholic beverages in public places

c. Consumption of alcoholic beverages by students under the legal drinking age

d. Abuses of alcoholic beverages.

2. There will be no consumption of alcoholic beverages in a motor vehicle while on University property or on University streets.

3. Consumption of alcoholic beverages is restricted to students' rooms in residence halls, if they are of legal drinking age.

4. The possession or consumption of alcoholic beverages shall not be permitted in public places; that is: lounges, game rooms, study rooms, kitchens, laundries, or patios.

5. There will be no public display of alcoholic beverages.

6. The University discourages the drinking of alcoholic beverages, and other abuses of alcoholic beverages. Being under the influence of alcohol is considered a breach of conduct and students who violate these standards are subject to disciplinary action.

Violations of the above regulations and laws will subject students to criminal prosecution as well as campus-based charges.

## C. Suspension Pending Final Disposition

The University reserves the right through the Chancellor or his designee to suspend a student, faculty member, administrator, and other employee between the time of the initiation of charges and the hearing to be held. Such decision will be made based on whether the

person's continued presence within the University community will constitute a clear and immediate danger or disruption to the University. In such circumstances, the hearing will be held as promptly as possible.

#### V. DISSEMINATION

A copy of the Drug and Alcohol Education Policy will be distributed on an annual basis to each employee and student of the University. A distribution to all enrolled students will occur as a part of the registration process. The distribution to University employees will be administered by the University Personnel Office.

The Chancellor of the University shall ensure on a biennial basis that this policy is reviewed to assess its effectiveness and consistency of application of sanctions, and to determine the necessity for modification. This review shall be conducted by October 15 of every other year, beginning in 1992.

#### CONCLUSION

North Carolina A&T State University recognizes that the use of illegal drugs and the abuse of alcohol are national problems and that sustained efforts must be made to educate the University family regarding the consequences associated with drug and alcohol abuse. The primary emphasis in this policy has, therefore, been on providing drug and alcohol abuse counseling and rehabilitation services through the various programs and activities outlined above.

Past experience suggests that most members of the University family are law-abiding and will use this policy as a guide for their future behavior and as a mechanism to influence their peers and colleagues in a positive direction. However, those who choose to violate any portions of this policy will pay the penalty for non-compliance. The main thrust of this policy has been to achieve a balance between its educational and punitive components.

The effective implementation of this policy rests on its wide dissemination to all members of the University family. This will be accomplished by the dissemination procedure previously outlined and through its publication in the faculty handbook, student handbook, and University catalogue. Additionally, all affected individuals will be assured that applicable professional standards of confidentiality will be maintained at all times.

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